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BENLLOCH MARTÍNEZ (M.). **Notas sobre** *Aglaope infausta* **L.**—*Bol. Pat. veg. Ent. agríc.* **8** pp. 1–6, 4 figs. Madrid, 1936–37 [1938].

Further field and laboratory observations on *Aglaope infausta*, L. [*cf. R.A.E.*, A **22** 609] were made in central Spain in 1934 and 1935. In the latter year, the larvae were observed, for the first time in Spain, on *Crataegus oxyacantha*. Although they usually feed on the leaves of fruit trees, they severely attacked the fruits of apple and, particularly, pear. In localities with a cold climate or during cold weather they pupated on the lower parts of trunks and in the soil to a depth of about 2 ins. Females fed on a concentrated sugar solution laid an average of 300 eggs each, and in a heavily infested orchard of plums, eggs were deposited on leaves as well as on the bark. The larvae usually feed on the underside of the leaves, and are therefore difficult to reach with sprays. Barium fluosilicate sprays gave no control on cherry, as the liquid did not adhere well. Parasites reared from pupae of this Zygaenid comprised *Masicera silvatica*, Fall., another Tachinid and the Ichneumonid, *Spilocryptus solitarius*, Tschek [*cf. loc. cit.*]. No appreciable degree of control was exercised by them.

BENLLOCH (M.) & DOMÍNGUEZ (F.). **La lucha contra la mosca de las cerezas.** *Rhagoletis cerasi* **(L.) Loew.** [Measures against the Cherry Fly.]—*Bol. Pat. veg. Ent. agríc.* **8** pp. 7–14, 3 figs., 7 refs. Madrid, 1936–37 [1938].

Observations on *Rhagoletis cerasi*, L., in a district in the Province of Cáceres, Spain, showed that there it has one generation a year. The pupae hibernate and some do not give rise to adults until the second year after pupation. In Cáceres, there are extensive cherry orchards and the fly requires no other host-fruits. Adults were present from mid-May until the end of July. The authors consider that glass bait-traps, such as are commonly used against *Ceratitis capitata*, Wied. [*R.A.E.*, A **19** 276] provide the best means of control, and 20,000 were distributed in the district. In cool, wet weather, 6 per cent. ammonia proved the best bait, while in hot weather and in situations exposed to the sun, a 2 per cent. solution of Clensel (liquid ammonia soap) was effective. In an experiment in which 390 males and 301 females were captured with Clensel, 236 (78 per cent.) of the latter contained eggs.

DEL CAÑIZO (J.). **Pentatómidos perjudiciales al trigo.** [Pentatomids harmful to Wheat.]—*Bol. Pat. veg. Ent. agríc.* **8** pp. 15–26, 10 figs., 8 refs. Madrid, 1936–37 [1938].

Aelia rostrata, Boh., is a common pest of wheat throughout Spain and also in Portugal. Observations since 1933 in several regions of Spain have shown that, about a month after harvest, late adults migrate from the fields to winter quarters among weeds or débris. The survivors reappear in wheat fields in May, or sometimes at the end of April, and pair, and females deposit batches of about 12 eggs, mostly on dried leaves at the base of the stalks. The nymphs hatch at the end of May or beginning of June and feed on the grains, and the adults continue feeding in them even after harvest. Females of this generation that mature early give rise to nymphs that develop during harvest in June–July, but most of these perish for lack of food and moisture.

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Under favourable conditions, this Pentatomid multiplies enormously, up to 30 individuals per ear having been observed, and causes serious injury to wheat [*cf. R.A.E.*, A **23** 287], especially to late varieties. Its natural enemies include a Scelionid egg-parasite of the genus *Telenomus*, which was abundant in Aragon, and the Tachinid, *Gymnosoma rotundatum*, L., the larvae of which develop and hibernate in the adult bugs. Sowing early varieties of wheat is recommended, and in severely infested localities wheat should be replaced by barley, which ripens a month earlier. Burning the fields over in spring destroys the hibernating adults.

During his investigations, the author observed an undescribed Pentatomid of the genus *Eurygaster* also attacking wheat in the Province of Toledo. It resembled *A. rostrata* in its bionomics.

DEL CAÑIZO (J.). **Las plagas de langosta en España.** [Locust Plagues in Spain.]—*Bol. Pat. veg. Ent. agríc.* **8** pp. 27–48, 12 figs. Madrid, 1936–37 [1938].

Old chronicles refer to locust outbreaks in Spain in 1584, 1619, 1682, 1685–86, 1754, and 1775. Extensive outbreaks occurred in 1890–92, 1910–13 and 1922–23, and a very severe one developed in 1935. The principal species over most of the country is *Dociostaurus maroccanus*, Thnb., but in some places, such as the eastern part of the Province of Albacete, it is *Calliptamus italicus*, L.

The areas principally subject to locust invasions are in the south-west, and the main permanent breeding areas are the district of La Serena, in Badajoz, the valley of Alcudia in Ciudad Real, and the Monegros area in Aragon. In all these provinces, much of the land belongs to extensive private estates and is largely uncultivated. This creates favourable conditions for locust breeding, while the extent of egg-deposits makes their control in winter difficult. The climate and vegetation of the breeding areas are briefly described, and some data are given on the natural enemies of *D. maroccanus* [*cf. R.A.E.*, A **19** 277].

Control measures in Spain include spraying the hoppers with gasoline and setting it on fire, and the use of zinc barriers, arsenical sprays and poison baits [*cf.* next abstract]. A law passed in 1908 makes it compulsory for landowners to report infested areas and to dig up the eggs in winter. The control of hoppers by spraying, etc., in spring is aided by the State, which supplies machinery and materials.

MORENO MÁRQUEZ (V.). **Los cebos envenenados contra la langosta.** [Poison-baits against Locusts.]—*Bol. Pat. veg. Ent. agríc.* **8** pp. 49–56. Madrid, 1936–37 [1938].

Large-scale experiments on the use of poison baits against *Dociostaurus maroccanus*, Thnb., carried out in the Province of Badajoz in 1935 proved that this method of control has many advantages over others. The formula recommended is 100 lb. bran (half of this quantity may be replaced by sawdust or dry dung), 2 lb. sodium arsenite and 7 gals. water. The sodium arsenite may be replaced by 2 lb. Paris green, 3 lb. white arsenic, or 4–5 lb. sodium arsenate. The addition of attractants proved to be useful, but not strictly necessary. The usual instructions for the preparation and distribution of baits are given. The quantity of bait per acre should vary

according to the density of infestation, but 54 lb. is the average recommended. A comparison showed that a given area could be treated with bait at about 56 per cent. of the cost of using a spray.

In preliminary experiments, a bait made of 100 lb. bran, 3 lb. sodium fluosilicate and 3 gals. olive oil instead of water gave very satisfactory results, but it is rather expensive.

DELGADO DE TORRES (D.). **Pérdidas causadas en frutales y olivos por los insectos en España.** [Orchard and Olive Crop Losses in Spain caused by Insects.]—*Bol. Pat. veg. Ent. agríc.* **8** pp. 57–64. Madrid, 1936–37 [1938].

Tables are given showing for the years 1933–34 and 1934–35 the losses caused by insects in orchards and olive plantations in the various provinces of Spain, the numbers of plants treated for their control, and the cost to the State of insecticides and to the State and individuals of labour. These figures are discussed; they show annual losses of about £1,000,000 and £700,000 due to orchard and olive pests, respectively.

MENDIZÁBAL VILLALBA (M.). **Notas para un estudio de las especies españolas del género** *Vesperus* **(Col. Ceram.).** [Notes for a Study of Spanish Species of *Vesperus*.]—*Bol. Pat. veg. Ent. agríc.* **8** pp. 65–86, 23 figs., 62 refs. Madrid, 1936–37 [1938].

A list is given of 17 species and varieties of the Cerambycid genus *Vesperus*, together with notes on their morphology and distribution in Europe and northern Africa, and a key to both sexes of some of them. The majority occur in Spain, where several cause severe injury at times to agricultural and forest plants. Adults appear to occur throughout the year. In the Province of Almería, eggs, which were laid on the plants, were observed from November onwards and larvae were first seen on 21st February. The young larvae wandered on the bark and then dropped to the ground and fed voraciously on the roots, often killing the plant. Pupation took place about mid-August. Various methods for controlling the eggs, larvae and adults are reviewed from the literature. In Spain, watering the ground with a 0·5 per cent. solution of sodium cyanide has given good results against the larvae.

GÓMEZ CLEMENTE (F.). **Experiencias de lucha contra la** *Ceratitis capitata* **con cazamoscas de vidrio.** [Experiments in the Control of *C. capitata* with Glass Bait-traps.]—*Bol. Pat. veg. Ent. agríc.* **8** pp. 99–117, 3 figs., 4 graphs, 15 refs. Madrid, 1936–37 [1938].

In further experiments with glass bait-traps against *Ceratitis capitata*, Wied., in Valencia [*cf. R.A.E.*, A **19** 276] made in 1932–34, various baits were compared with a standard 25 per cent. solution of vinegar. In tests in 1933 and 1934, a 1·5 per cent. solution of liquid ammonia soap (Clensel), and water in which 5–7 per cent. of bran had been steeped for 24–48 hours, caught more flies than the vinegar, in one test 3 per cent. ammonium fluoride caught nearly 4 times as many, and in another in 1933 orange juice was almost as effective. Observations on the influence of temperature showed that catches were very small below 10°C. [50°F.]. Vinegar proved the most attractive bait up to 17–18°C. [62·6–64·4°F.], but from 19–20°C.

[66·2–68°F.] upwards, when the numbers of flies caught greatly diminished, it was surpassed by orange juice, Clensel, and water in which bran had been steeped. The strength of the bait solution was found to be an important factor. Vinegar caught more flies when diluted to 25 per cent. than when used at 100 or 50 per cent. strengths, and Clensel was more effective at 1·5 than at 3·5 per cent. The catches were larger in traps most exposed to sunlight, about 5½ ft. above the ground.

González de Andrés (C.). **Las plagas del olivo en España.** [Olive Pests in Spain.]—*Bol. Pat. veg. Ent. agríc.* **8** pp. 118–124, 1 map, 9 refs. Madrid, 1936–37 [1938].

A list is given of 11 insect pests of olives in Spain, and their distribution is shown on a map. Those that cause the most damage are *Dacus oleae*, Gmel., against which is used a bait-spray consisting of 1 part of a mixture of 180 lb. beet molasses, 1½ gals. water and 5 lb. sodium arsenate diluted with 10 parts water; *Liothrips oleae*, Costa, which is controlled by tent fumigation with hydrocyanic acid gas [*R.A.E.*, A **22** 607]; and the Scolytids, *Phloeotribus scarabaeoides*, Bern., and *Hylesinus oleiperda*, F., against which pruning and the removal of all débris is recommended. The others comprise *Clinodiplosis oleisuga*, Targ., *Hysteropterum grylloides*, F., *Euphyllura olivina*, Costa, *Saissetia oleae*, Bern., *Lepidosaphes ulmi*, L., *Aspidiotus hederae*, Vallot, and *Prays oleellus*, F.

Bohorquez (R.). **Experiencias de lucha contra la mosca del olivo (*Dacus oleae* Rossi) por medio de substancias atractivas.** [Control Experiments against the Olive Fly, *D. oleae*, by Attractants.]—*Bol. Pat. veg. Ent. agríc.* **8** pp. 125–139, 9 graphs. Madrid, 1936–37 [1938].

Tables and graphs show the numbers of adults of *Dacus oleae*, Gmel., caught in bait-traps in olive plantations by each of 20 substances, in experiments begun in Andalucía in 1934. The numbers of flies caught in a comparative test were 1,336 with 10 per cent. ammonia, 508 with 4 per cent. ammonium fluoride, 400 with 3 per cent. Clensel and from 445 to 128 with 7 other baits.

Ruiz Castro (A.) & Mendizábal (M.). **La "roya colorada," producida por *Empoasca libyca* de Bergevin (Hem. Hom.), en los parrales de Almería.** [The "coloured Rust" produced by *E. libyca* in Vineyards in Almería.]—*Bol. Pat. veg. Ent. agríc.* **8** pp. 150–161, 9 figs., 11 refs. Madrid, 1936–37 [1938].

Of recent years grape-vines in Almería have been attacked, seriously in some districts, by the Jassid, *Empoasca libyca*, Berg., which causes discoloration and crinkling of the leaves. Severely infested vines put forth new shoots and the grapes are stunted and ripen late. The attack usually becomes noticeable in July and decreases in October. In the laboratory in July the life-cycle lasted 17 days. *E. libyca* was also observed on potato and maize, but caused no evident injury to them, and on *Cynoglossum* growing wild.

Sprays containing nicotine (0·7 lb. per 100 gals. water) or a nicotine soap applied to vines on the 9th and 10th July considerably reduced

the numbers of Jassids, but as some adults appeared on 25th July a nicotine dust was applied and freed the plants from infestation. Bordeaux mixture repelled the Jassids, and infestation by them is unimportant in localities where this spray is frequently applied.

Ruiz Castro (A.). **Experiencias de lucha contra el " melazo " de la parra** (*Pseudococcus citri* **Risso**). [Experiments in Control of *P. citri* on the Grape-vine.]—*Bol. Pat. veg. Ent. agríc.* **8** pp. 162–170, 19 refs. Madrid, 1936–37 [1938].

In the coastal districts of Almería, *Pseudococcus citri*, Risso, is the chief pest of vines, causing direct injury to the plants and grapes, and rendering the latter unsaleable. Its natural enemies there, a list of which is given, include the Encyrtids, *Anagyrus bohemani*, Westw., *Tanaomastix* (*Leptomastidea*) *abnormis*, Gir., *Prochiloneurus bolivari*, Merc., and *Signiphora conjugalis*, Merc., as well as a number of Coccinellids and other predators. They are not of much value in control, and many of them are themselves attacked by parasites. The Coccinellid, *Cryptolaemus montrouzieri*, Muls., has been successfully established in the region of Valencia, but attempts to establish it against *P. citri* in Almería have failed.

From tests with 20 different sprays applied at various seasons, it is concluded that winter treatments are more effective than those applied during the vegetative period. The latter were useful only if applied before the clusters of grapes became infested (July and first half of August), after which time they were ineffective and indeed harmful to the grapes if they included mineral oils. Removal of the old bark was desirable but not essential. The best winter treatment was a spray of 4 lb. tar oil and 8 lb. quick-lime in 10 gals. water. Excellent results were obtained by carefully scraping the bark in June and spraying with a good oil emulsion. The plants were not harmed if mineral oil with a sulphonation index under 23 and a density of 0·85 was used at a concentration of 2 per cent., provided that the spray was applied before the grapes assumed a ripe colour. For successive applications during the vegetative period, the formula recommended is 1·5 lb. nicotine, 15 lb. soft soap, 2 lb. sodium carbonate, 5 gals. alcohol, and 100 gals. water. The spray that gave the greatest mortality (99 per cent.) during this period consisted of 6 lb. carbolic acid, 30 lb. potash soap and 5 gals. alcohol in 100 gals. water. It caused slight scorching at the lower parts of the grapes where drops accumulated, but did not injure the leaves and shoots.

Planes García (S.). **La tensión superficial de las emulsiones en relación con su eficacia insecticida.** [The Surface Tension of Emulsions in Relation to their insecticidal Efficiency.]—*Bol. Pat. veg. Ent. agríc.* **8** pp. 187–196, 4 figs., 3 graphs, 6 refs. Madrid, 1936–37 [1938].

The characters that determine the insecticidal properties of mineral oils have been extensively studied, but so far very few investigators have worked with oils of animal or vegetable origin. As these are much more easily obtainable in Spain, the author carried out a series of tests on them. In general they are characterised by a lower volatility and a higher viscosity than mineral oils. The characteristics that influence the insecticidal effect of oil emulsions are their stability,

quick-breaking emulsions being the most effective, the proportion of the emulsifier in them [*cf. R.A.E.*, A **13** 343], and the size and homogeneity of the droplets of oil. All these characteristics are closely related to surface tension, acting through the film of emulsifier surrounding the droplets. It may therefore be concluded that the surface tensions of the emulsions serve to indicate these characters, since differences in the surface tensions of the oils commonly used in them are very small, the figures, taking the surface tensions of water as 1, being 0·420 and 0·482.

This conclusion was verified by testing three proprietary mineral oil emulsions and two prepared in the laboratory, diluted to contain 2 per cent. oil, against *Chrysomphalus dictyospermi*, Morg. A mortality of 100 per cent. was obtained with an emulsion of which the surface tension was 1, and with the others mortality decreased to 80 per cent. as the surface tension fell to 0·736. Tests with emulsions of animal and vegetable oils at the same dilution were made on *Lepidosaphes gloveri*, Pack., which is more resistant than *C. dictyospermi*. The highest mortality obtained was 95 per cent., with an emulsion of olive oil of which the surface tension was 0·823. Almost the same direct relation between mortality and surface tension was observed as in the case of the mineral oils. The percentage mortalities given by two other emulsions of olive oil and emulsions of sardine and herring oils, of which the surface tensions were 0·725, 0·525, 0·7 and 0·7, were 82, 75, 90 and 88, respectively. The correlation was not shown by emulsions of linseed and shark oils, and the author attributes this to their low viscosity and the low melting point of their fatty acids.

Gómez Clemente (F.) & Regueral (F. G.). **Rectificación de las tablas actualmente utilizadas en la fumigación cianhídrica de los agrios en España.** [Corrections to the Hydrocyanic Acid Gas Fumigation Tables for *Citrus* at Present used in Spain.]—*Bol. Pat. veg. Ent. agríc.* **8** pp. 197–214, 3 figs., 8 refs. Madrid, 1936–37 [1938].

Dosage tables, based on those of Woglum [*R.A.E.*, A **11** 535] but with the measurements converted to the metric system, are given for the tent fumigation of *Citrus* in summer and winter with hydrocyanic acid gas generated from sodium cyanide and potassium cyanide. These tables have been in use in Spain for some time, but the way in which the measurements were originally converted rendered the units inconvenient.

Lever (R. J. A. W.). **Entomological Notes.**—*Agric. J. Fiji* **9** no. 2 pp. 14–18, 1 map, 9 refs. Suva, June 1938.

In April 1938, *Promecotheca reichei*, Baly, was found infesting *Pritchardia pacifica* on Pago Pago (eastern Samoa), and some palms near the shore showed evidence of having been attacked by *Oryctes rhinoceros*, L. In March and April, stocks of *Syntomosphyrum indicum*, Silv., were imported fron New South Wales and were liberated on the island of Viti Levu (Fiji), for the control of *Dacus* (*Chaetodacus*) *passiflorae*, Frogg., and *D.* (*C.*) *xanthodes*, Broun ; 25 per cent. parasitism by it was observed in larvae collected from guavas at the place where the first liberation was made. *Platypus gerstaeckeri*, Chap., and a Scolytid were both found infesting *Podocarpus vitiensis* and

Endospermum sp. in Viti Levu. In May, a shipment of *Liothrips urichi*, Karny, was despatched from Fiji to the Solomon Islands for the control of *Clidemia hirta*.

ANDREWARTHA (H. G.), DAVIDSON (J.) & SWAN (D. C.). **Vegetation Types associated with Plague "Grasshoppers" in South Australia.** —*Bull. Dep. Agric. S. Aust.* no. 333, 47 pp., 73 figs., 1 col. pl. Adelaide, 1938.

During investigations on the ecology of *Chortoicetes terminifera*, Wlk., and *Austroicetes cruciata*, Sauss., in South Australia [*R.A.E.*, A **26** 584], a survey was made of the vegetation types associated with their breeding areas, and numerous photographs of these are reproduced. *A. cruciata* is rare outside the semi-arid zone and reaches outbreak numbers only in uncultivated grasslands, where suitable breeding areas are created by disturbing the compact soils to form pasture, stock roads or headlands. *C. terminifera* develops into swarms in areas north of the semi-arid zone, where favourable habitats are afforded by water-courses, depressions that retain moisture, and flat areas that occur at the base of hills and receive their run-off. Such habitats are characterised by herbaceous perennials, particularly grasses, as well as by ephemeral plants; the latter provide food during the favourable season, while the former enable the locusts to survive the drought.

VEITCH (R.). **Insecticides.**—*Qd agric. J.* **49** pt. 6 pp. 584–603. Brisbane, June 1938.

This is a general account of the dusts, poison baits, sprays and fumigants commonly used for the control of insects in Queensland, with notes on their preparation. A section on tent fumigation of *Citrus* with hydrocyanic acid gas includes dosage tables for potassium cyanide and for calcium cyanide in the form of Cyanogas dust or of Calcid briquettes.

APPEL (O.) Ed. **Pflanzenschutz. Verhütung und Bekämpfung der Pflanzenkrankheiten.** [Plant Protection. The Prevention and Control of Plant Pests and Diseases.]—In SORAUER (P.). *Handb. Pflanzenkr.* 6. Band, 4. Aufl., Lief. 2, pp. 289-576, illus., many refs. Berlin, P. Parey, 1938. Price *Mk.* 16·60.

This second part of the sixth volume of Sorauer's text-book [*cf. R.A.E.*, A **25** 262] comprises the conclusion (pp. 289-332) of the section on physical measures for combating pests and diseases of plants, and the greater portion of the section on chemical control. This section contains accounts of the principal inorganic and organic substances that are used for the control of plant pests and diseases and descriptions of biological methods of testing their efficiency. The concluding subsection on physical and chemical tests is to be continued.

MCHARGUE (J. S.) & CALFEE (R. K.). **Nicotine Thiocyanate. A Contact Insecticide.**—*Industr. Engng Chem.* **29** pp. 1232–1233, 8 refs. Easton, Pa., November 1937.

In an attempt to evolve a more effective nicotine insecticide, a study was made of nicotine thiocyanate, which was prepared by the reaction of nicotine with ammonium thiocyanate. With dilutions based on the actual nicotine content, a 1 : 3,000 dilution of nicotine thiocyanate without a spreader was as effective as a 1 : 1,200 dilution

of 40 per cent. nicotine sulphate, which gave 96·7 per cent. mortality of *Aphis rumicis*, L., after 24 hours, when applied as a fine mist to the under surface of leaves in the shade at 80°F. The addition of soap as a spreader to nicotine thiocyanate induced a more complete contact, but resulted in a toxicity that was much lower than anticipated in comparison with nicotine sulphate, while the spray caused severe foliage injury to many plants. The use of water containing considerable amounts of dissolved salts also resulted in apparent lowering of toxicity accompanied by intense foliage injury. This was further investigated by using diglycol oleate and triethanolamine oleate as spreaders instead of sodium oleate to ascertain the effects of reaction between the ionisable thiocyanate and alkali ions in solution, and it was found that a high degree of toxicity was retained and injury to the foliage was negligible. The organic oleates were not quite so efficient as spreaders, but the addition of a small quantity of resin greatly increased their wetting properties. The sulphonated higher alcohols and the sodium salts of naphthalene sulphonic acids were also suitable as spreaders since, owing to very efficient coverage, the concentration of sodium ions was small. Application of nicotine thiocyanate at high temperatures or in bright sunlight, spraying in the greenhouse rather than in the open, and excessive spraying were also conducive to plant injury.

Tetranychus telarius, L., and adults and larvae of the bean beetle [*Epilachna varivestis*, Muls.] were not affected by nicotine thiocyanate in practical spray concentrations, but were temporarily paralysed by high concentrations. Further tests were made on *T. telarius* in the greenhouse on infested bean and cucumber plants on cloudy days at temperatures between 75 and 80°F. with a continuous sprayer. Since the spreaders did not wet the web, plants were selected that had not been infested to the extent of web formation. Nicotine thiocyanate was toxic at sufficiently high concentrations in the presence of a suitable wetting agent, but the combination of the thiocyanate ion with an alkali ion, as in the case of sodium oleate, reduced the toxicity of the spray solution.

DA COSTA LIMA (A.). **Sobre dois microhimenopteros que parasitam a lagarta rosea da** *Platyedra gossypiella* **(Saunders) no Brasil.** [On two Hymenoptera that parasitise the Larva of *P. gossypiella* in Brazil.]—*Chacaras e Quintaes* 15th December 1937 repr. 5 pp., 4 figs. S. Paulo, 1937.

A list is given of the Hymenopterous parasites that attack larvae of *Platyedra gossypiella*, Saund., in cotton in various parts of the world. All but one of those observed in Brazil have been mentioned in a previous paper [*R.A.E.*, A **8** 445], but the species there recorded as *Bracon* sp. is referred to the genus *Ipobracon* and described. The other parasite, bred from *P. gossypiella* in 1936, is considered to be *Microbracon* (*Habrobracon*) *hebetor*, Say.

KREIBOHM DE LA VEGA (G. A.). *Astylus atromaculatus*, **Blanch. Insecto cuyas larvas y adultos son dañinos para el algodonero.** [*A. atromaculatus*, an Insect of which the Larvae and Adults are injurious to the Cotton Plant.]—*Rev. indust. agríc. Tucumán* **27** no. 10–12, pp. 203–208, 7 figs., 4 refs. Tucumán, 1937.

Descriptions are given of the adult and larva of the Melyrid, *Astylus atromaculatus*, Blanch., which has caused considerable injury to cotton

in Argentina of recent years. The larvae, which appear in spring, eat out the newly sown seeds in the soil, and, in severe infestations, also attack the cotyledons of the young seedlings. They pupate in the soil. The adults usually appear in January and fly to plants with flowers rich in pollen; they cause mechanical injury to the floral organs of cotton, cereals, lucerne, and sunflower. Infestation by the larvae usually occurs in fields in which such plants were growing in the preceding year.

The larvae can be controlled by baits of bran, cotton-seed cake, or rye-flour paste, poisoned with 2 per cent. calcium arsenate or Paris green or 4 per cent. lead arsenate. The adults are easily collected in the flowers, especially on cold days.

MANOFF (I.). **Estudio de algunos problemas que presenta el empleo de los arseniatos de plomo y de calcio como insecticidas en la pulverización de las plantas.** [A Study of some Problems in the Use of the Arsenates of Lead and Calcium as Insecticides in the Spraying of Plants.]—*Rev. indust. agríc. Tucumán* **27** no. 10–12 pp. 209–225. Tucumán, 1937.

Details are given of chemical investigations carried out in Tucumán, Argentina, since 1937 on the factors influencing scorching of the foliage of plants, particularly cotton, by sprays of lead and calcium arsenate. Scorching is caused by soluble arsenic pentoxide, and a good lead arsenate spray should contain not more than 0·7 per cent. soluble arsenic, though calcium arsenate may contain slightly more. The contents of total arsenic and soluble arsenic are given for a number of commercial lead and calcium arsenates, but suspensions of these substances often show considerable variation in the quantity of soluble arsenic present owing to impurities in the water employed. Tables show the percentages of soluble arsenic produced when samples of the two arsenates were suspended in waters of different origins, chemical analyses of which are given. They were highest in waters that contained the greatest amounts of impurities. Tests on the effects of the various salts that were recovered showed that, in general, less soluble arsenic was formed from calcium than from lead arsenate. Carbon dioxide, which may be present in the water or the atmosphere, or produced by the plants themselves, slightly reduced the amount of soluble arsenic from lead arsenate in waters with a high content of salts, but considerably increased it in the case of calcium arsenate. In further tests with various waters, the amount of soluble arsenic was proportionately less at concentrations of 8 per cent. arsenate than at 0·5, so that there is no advantage in increasing spray dilution beyond the point of maximum insecticidal efficiency. It is concluded that only arsenates containing a minimum of soluble arsenic and water of suitable quality should be used. Analysis should be supplemented by a practical test at the actual spraying strength of the suspension. If it is found that, despite the arsenate being of good quality, the available water gives rise to a high percentage of soluble arsenic, the insecticide should be used as a dust, the lead arsenate being mixed with flour and the calcium arsenate with powdered slaked lime, which serves to neutralise soluble arsenic as well as acting as a carrier.

KALSHOVEN (L. G. E.). **De boekenworm in Nederlandsch-Indië.** [The Book Beetle in the Netherlands Indies.]—*Ent. Meded. Ned.-Ind.* **4** pt. 1–2 pp. 10–16, 1 fig., 1 pl., 14 refs. Buitenzorg, 16th June 1938.

The author discusses records, chiefly from the Netherlands Indies, of injury to books by Coleoptera, and states that while *Sitodrepa panicea*, L., appears to be the species that most often attacks them in the temperate zone, *Lasioderma serricorne*, F., and *Gastrallus laticollis*, Pic, are the chief, if not the only, ones concerned in the Netherlands Indies. *Gastrallus* is not uncommon in books at Batavia and Buitenzorg, those hitherto attacked by it being volumes bound in the Netherlands Indies, while *Lasioderma* has been observed in books bound elsewhere. The adults of *Gastrallus* found in books varied considerably in size, but the largest holes made by them were 1 mm. in diameter, which is rather smaller than those made by *Lasioderma*. The holes made by the larvae resembled fine pinholes. Certain parts of the volumes were more injured than others, and this is attributed to their containing a greater amount of paste or to covering with bookbinders' linen, the dressing of which would appear to be a food.

A species of *Calotermes* (*Cryptotermes*) that attacks dry wood sometimes passes from shelves or boxes into books and bores passages $1\frac{1}{2}$ mm. in diameter.

ZACHER (F.). **Sonderbare Frassgewohnheiten und merkwürdige Frassbilder.** [Odd Feeding Habits and remarkable Feeding Patterns.]—*Mitt. Ges. Vorratsschutz* **14** no. 4 pp. 41–43, 1 fig. Berlin, July 1938.

This article includes a record of damage to the linen-bound cover of a book in Egypt by *Thermobia aegyptiaca*, Luc.

BOURIQUET (G.). **Note concernant les maladies des plantes cultivées à la Réunion.**—*Rev. agric. Réunion* (N.S.) **43** pp. 33–38. Saint-Denis, 1938.

The Arthropods recorded in the course of this paper are *Bemisia manihotis*, Frappa, and *Tetranychus telarius*, L. (*bimaculatus*, Harv.) on cassava, *Eriosoma lanigerum*, Hsm., on quince, and *Xyleborus coffeae*, Wurth, and *Coccus* (*Lecanium*) *viridis*, Green, on coffee (*Coffea arabica*). The first four identifications are tentative. Mosaic disease of cassava, of which *B. manihotis* is considered a possible vector in Madagascar [*R.A.E.*, A **26** 413, 455], has not been observed in Réunion.

Pests of Citrus Trees and Fruit.—*Leafl. Dep. Agric. Cyprus* no. 24, 3 pp. Nicosia, 1938.

Very brief notes are given on the habits and control of the principal pests of *Citrus* in Cyprus, other than *Ceratitis capitata*, Wied. They comprise the Coccids, *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask., *Coccus* (*Lecanium*) *hesperidum*, L., and *Lepidosaphes beckii*, Newm., and the Aphid, *Toxoptera aurantii*, Boy. The Coccids, of which *A. aurantii* is the commonest, can be controlled by fumigation with

hydrocyanic acid gas or by spraying with oil emulsions [*cf. R.A.E.*, A **25** 66]. The same measures are effective against *T. aurantii*, but it can also be destroyed by a spray of nicotine sulphate and soap.

Report of the Forest Products Research Board for the Year 1937.— Med. 8vo., vi+87 pp., 8 figs., 9 pls. London, H.M.S.O., August 1938. Price 2*s*.

Part of this report (pp. 47–53) deals with research connected with wood-boring insects in England. In further experiments on the removal of starch from timber in order to prevent infestation by *Lyctus*, 20 oak trees were girdled near the top of the main trunk, 10 of the girdles being brushed over with creosote to ascertain whether this preservative would prevent the slight staining that was noticed in the previous trials [*R.A.E.*, A **26** 635]. The trees have not yet been felled, but samples bored from two of them indicate that although depletion of starch is considerable, it is not so complete as in the preliminary experiment. Storage of timber in the form of logs [*cf.* **22** 543] is effective, although in some districts the logs may be attacked by pinhole borers. Ash logs appear to keep well, but the sapwood of oak is spoiled by fungal decay unless the logs are kept on skids under cover and their ends painted with creosote soon after felling. When ash bolts were immersed in water, they were completely devoid of starch nine months later. Half-inch ash boards kept in a model kiln at 40°C. [104°F.] and a relative humidity of 98 per cent. were free from starch in 2–3 weeks [*cf.* **26** 190]. In laboratory tests on wood preservatives for the prevention of attack by *Lyctus*, the immersion of samples of oak sapwood for five minutes in a solution of chlorinated naphthalene wax in benzene [**26** 190] prevented infestation for at least nine months, while treatment with a mixture of creosote and paraffin (1 : 2) was effective for 11 months but discoloured the timber.

Investigations into the life-cycle of *Xestobium rufovillosum*, DeG., have confirmed earlier work showing that the presence of severe decay (induced in oak by *Phellinus cryptarum* and in willow by *Polystictus versicolor*) and a high moisture content are very favourable for the rapid development of the larvae [**25** 494; **26** 190]. *P. cryptarum* produces decomposition of both lignin and carbohydrates in oak sapwood, the chemical changes being characteristic of white rots. In samples of oak sapwood that had lost about 40 per cent. of their dry weight through decay, subsequent attack by *Xestobium* resulted in additional loss of only 6 per cent. of the original weight, although tunnelling by the larvae caused serious mechanical disintegration of the wood; cellulose showed the greatest amount of depletion, but the larvae had apparently consumed portions of all the major components. From previous observations on infestation by *Xestobium* of the heartwood of old oak structural timber in buildings, however, it is concluded that if a fungus played any part in the decomposition of the wood, it was of the brown and not of the white rot type, and that there can be no question of the association of a specific fungus with the beetle.

Instances of serious damage to green English oak by the pinhole borer, *Platypus cylindrus*, F., were noted during the year and records are being kept of its occurrence and distribution.

KEARNS (H. G. H.), MARSH (R. W.) & MARTIN (H.). **Combined Washes. Progress Report.—IV. The phytocidal Properties of Petroleum Oil Sprays alone and in combination with Lime-sulphur.** —*Rep. agric. hort. Res. Sta. Bristol 1937* pp. 65–77, 4 refs. Bristol [1938].

Further investigations [*cf. R.A.E.*, A **25** 708] were carried out in south-western England in 1937 on the phytocidal properties of petroleum oil sprays alone and in combination with lime-sulphur. Grade G petroleum oils were again emulsified with a 20 per cent. solution of sulphite lye to stock emulsions containing 67 per cent. oil by volume. The sprays were applied to apple at the green flower and petal fall stages, to black currants at the tight cluster stage and to plum at petal fall, as they are likely to cause most injury at these stages. The concentrations of stock emulsion used were 7·5, 1, 7·5 and 1 per cent., respectively.

The following is based on the authors' summary: Preliminary field trials on several varieties of apple showed that the general correlation between the phytocidal properties and the degree of refinement as measured by unsulphonated residue established for acid-refined oils held also for solvent-refined oils, which are likely to prove considerably cheaper. Extensive trials with sprays consisting of emulsions of acid- or solvent-refined petroleum oil with lime-sulphur and nicotine applied at petal fall of apples showed that the spray could be applied to all varieties not sensitive to sulphur without risk of injury to the leaves. The addition of the oil emulsion to a petal-fall lime-sulphur spray did not reduce the control of apple scab on the variety tested; but there was an indication that the oil emulsion may have reduced the number of apples picked. The emulsion of acid-refined oil applied to black currants and to plums caused a negligible amount of injury.

A subsidiary experiment showed that sprays containing about 1 per cent. oil emulsion in combination with lead arsenate or nicotine sulphate caused no injury to the foliage of apple when applied early in July.

KEARNS (H. G. H.) & MARTIN (H.). **The Control of Plum Sawfly (*Hoplocampa flava* L.)**—*Rep. agric. hort. Res. Sta. Bristol 1937* pp. 78–84, 1 pl., 6 refs. Bristol [1938].

In this paper are summarised the results of studies on the life-history and control of *Hoplocampa flava*, L., on plum, carried out in south-western England in 1934–37. Much of the information on the life-history is similar to that already noticed [*R.A.E.*, A **21** 560]. The sawflies are most active towards the end of warm, still, sunny days. Each female lays about 30 eggs, which hatch in about 14 to 18 days. The probable degree of infestation of plum trees may be determined, when the blossoms are nearly full, by jarring the tree and catching any sawflies dislodged in a tray. The spray recommended on the basis of tests in 1936 [**25** 709] and 1937 consists of a summer oil emulsion containing 0·67 per cent. actual oil, with the addition of enough powdered root or extract of derris or cubé (*Lonchocarpus*) to give at least 0·004 per cent. rotenone content; it should be applied just before the hatching of the majority of the eggs, which generally occurs when the receptacles have split to two-thirds of their length. A second application, if necessary, should be made a week later. An

extract of cubé gave a more potent combined spray than the powdered root. It is important to apply a drenching spray, which should reach the top of the tree (as the upper parts are frequently the most severely infested) and thoroughly wet the open ends of the receptacles. The lower side of the leaves should also be wetted for the control of red spider [*Paratetranychus pilosus*, C. & F.].

WALTON (C. L.). *Tarsonemus spirifex* **March., as an Oat Pest.**—*Rep. agric. hort. Res. Sta. Bristol 1937* pp. 93–95, 3 refs. Bristol [1938].

Infestation of oats by *Tarsonemus spirifex*, Marchal, was recorded in Gloucestershire in 1912, and was observed on farms in Wiltshire and Somerset in 1937. This mite, a brief description of which is given, occurred within the leaf-sheaths and glumes. The attack gave rise to stunting, uneven growth, reddish discoloration of the stems, marked twisting of the rachis of the panicle, and some " blindness."

DAVIES (W. M.). **The Aphis *Myzus persicae* Sulz., in selected Districts of Scotland.**—*Scot. J. Agric.* **21** no. 3 pp. 249-258. Edinburgh, July 1938.

The following is substantially the author's summary of a survey carried out in potato-growing areas in eastern Scotland in July and August 1936 to ascertain to what extent findings in Wales [*R.A.E.*, A **26** 379, etc.] were applicable to other parts of Great Britain: *Myzus persicae*, Sulz., was found in varying abundance on all the 43 farms visited, though not always on potatoes in the field; it occurred from sea level to the highest centre visited (850 ft.) and was common in both the north and south. As in North Wales, the highest Aphid populations occur most frequently at low altitudes and in sheltered gardens of urban areas. High Aphid counts on farms in exposed situations or remote from villages were apparently due to the proximity of swedes and other crucifers. In England and Wales, swedes rarely occupy the land in potato-growing districts later than February, but in many districts in Scotland they are either left to grow in the field until April or May, or the roots are lifted, placed in rows and lightly covered with soil. In both cases, foliage is produced in the spring. There is evidence to show that the migration of winged Aphids to potatoes in June is, in general, determined by the occurrence of days when the maximum temperature exceeds 65°F., the relative humidity is less than 75 per cent. [*cf.* **23** 492], and the wind velocity is less than 5 miles per hour [*cf.* **24** 552]. Since, however, these conditions occur in this area when the gentle breezes come from the west, and not with the moist sea breezes, the general trend of Aphid migration appears to be from west to east. This is supported by the fact that high populations were recorded on crops immediately to the east of urban areas, whereas, with similar shelter, the counts were far smaller to the north, south or west of the towns.

WILSON (G. F.). **The Tarnished Plant Bug or Bishop Fly, *Lygus pratensis* L.—Précis of Present Knowledge.**—*J. R. hort. Soc.* **63** pt. 8 pp. 392–395. London, August 1938.

Much of the information in this account of *Lygus pratensis*, L., on chrysanthemum in south-eastern England is similar to that already

noticed [*R.A.E.*, A **20** 661]. A list of its more important food-plants is given. Overwintered adults only occasionally attack chrysanthemum cuttings; they usually oviposit on weeds in April and May. The nymphs hatch within a fortnight, feed on leaves and buds, and become adult from June onwards. Second-generation nymphs occur in early August. The bugs appear on chrysanthemum in summer and adults and nymphs are numerous from late July to September. It is possible that some of the eggs laid in August and September overwinter. The injury to the flower-buds is frequently hidden by the sepals and leaves until the blooms begin to open. Observations from 1921 to 1937 have shown that the worst attacks on chrysanthemum occur in autumns of high temperature, much sun and low rainfall, the severity varying with the variety. Plants kept well watered during dry periods in late summer proved more attractive to the Capsid than those suffering from drought.

Satisfactory control of nymphs and adults can be obtained by spraying with nicotine and soap at weekly intervals during August and September, and by applying nicotine dust during the early growth of the plants; foliage dusted with flowers of sulphur is repellent.

COHEN (M.). **The Tomato Leaf Miner and its Control.**—*J. Minist. Agric.* **45** no. 5 pp. 460–462, 1 pl., 3 figs. London, August 1938.

A summary is given of observations in 1937 on the tomato leaf-miner, *Agromyza* (*Liriomyza*) *solani*, Macq., in England. It was first recorded there in Middlesex in 1926 and was again present in the same locality and in Hertfordshire in 1935 and 1936 [*R.A.E.*, A **25** 668]. In January 1934, it was found in Jersey, where it caused considerable damage in 1936 and 1937 to plants in pots and those set out in the house. All stages are briefly described and also characters by which the larvae and adults may be distinguished from those of the chrysanthemum leaf-miner [*Phytomyza atricornis*, Mg.]. The adults occur about the lower surface of the leaves of seedlings and established plants and are not very active. The females pierce the leaf tissue with the ovipositor and feed on the sap that exudes from the puncture. Two or three eggs are usually inserted deeply into the lower surface of a leaf, but the number is increased in heavy infestations. The newly hatched larvae tunnel into the leaf tissue and make their way towards the upper surface. The mines generally follow the mid-rib of the leaf for a part of their course, but end in the blade. The mature larva cuts an irregular curved slit through the upper epidermis and pupates on the surface. The puparia adhere very lightly to the leaf, and are easily blown off. The larvae moult twice and become full-grown in about 10 days. The pupal period lasts 35–42 days at 60°F., and the life-cycle is completed in an average of 52 days. There are several generations annually.

This Agromyzid infests only tomato in England, although it has been recorded from other solanaceous plants elsewhere. The mines broaden as the larvae grow, and, when two or more larvae are present in a leaf, all the green tissue may be destroyed. Infestation of seedlings has not been observed, but young plants in 4-inch pots and those recently set out in the greenhouse are severely damaged. Injury is most serious in July and August, when the older leaves are attacked.

In material obtained from Jersey in April 1937, 35–40 per cent. of the puparia were parasitised by a Braconid [*cf. loc. cit.*].

The control measures recommended are fumigation with hydrocyanic acid gas or nicotine, which will kill the adult flies, and the use of a spray of 1½ oz. nicotine and 1–2 lb. soft soap in 20 gals. water, which kills all stages except the pupae, and so should be applied at intervals of 15–20 days. Solanaceous weeds that might serve as alternative food-plants should be destroyed.

SPEYER (E. R.), READ (W. H.) & ORCHARD (O. B.). **Animal Pests.**— *Rep. exp. Res. Sta. Cheshunt* **23** (1937) pp. 59–65. Cheshunt, Herts., 1938.

In 1937, further work was carried out at the Cheshunt Research Station on the life-history and control of *Thrips fuscipennis*, Hal., as a pest of roses in greenhouses [*cf. R.A.E.*, A **25** 668]. A search for overwintering thrips in soil samples from a nursery that had been heavily infested in the previous year gave negative results. During the winter of 1936–37 adult females were found hibernating in cracks in the bark of rose bushes grown under glass, both at the research station and in a commercial nursery, and also in a hollow piece of wood on the ground and in dry wood removed from a gutter board. None was, however, found in soil, moss or refuse beneath the plants. In the field, they have been collected from the bark of chestnut and beech together with *T. major*, Uzel. They were found to survive in very dry situations, whereas a saturated atmosphere in a small receptacle was fatal to them within a few hours. Under favourable conditions of temperature, they begin to breed in early February, but most of them do not emerge from hibernation until the end of the month. Examination of a potted rose bush, the flowers of which were severely infested in mid-summer, showed that eggs were present principally in the sepals or the flower stalks immediately adjoining them, and also in very young leaf or flower shoots. In experiments on control in three greenhouses in January, newly pruned bushes were sprayed with 2½ per cent. tar distillate, fumigated with hydrocyanic acid gas released from Cyanogas calcium cyanide scattered on the paths at the rate of 1 oz. per 1,000 cu. ft., or subjected to both treatments; but the thrips were found breeding at the bases of the leaf petioles within a week of the appearance of the young shoots, and the first crop of blooms was seriously damaged. As soon as it became obvious that dormant control was ineffective, weekly applications were made of a spray of an oil emulsion containing nicotine that had given promising results in the previous year [**25** 669], but this caused pronounced yellowing and slight hardening of the foliage, possibly owing to the soft nature of the growth, and, after six applications, it was discontinued. Experiments with other sprays and dusts are briefly described; none of them was effective, as the thrips are usually concealed within the rose buds, though many of the sprays were lethal when the insects were wetted with them.

Under experimental conditions, *Thrips tabaci*, Lind., oviposited on the calyces of unopened flower-buds of pink carnations, suggesting that the apparent immunity from attack shown by pink varieties may be due to the petals being unattractive as food for the larvae and adults. In tests with several highly susceptible varieties, larvae hatching from eggs deposited on the outside of the calyx when the buds were extremely young perished in large numbers unless the petals of opening flowers were available as a source of nourishment [*cf.* **24**

556]. Eggs were laid, and larvae were able to develop, on both the upper and lower surfaces of young leaves of cyclamen. When the flowers began to open, eggs were found only at the bases of the inner sides of the petals.

In October, a consignment of *Scolothrips sexmaculatus*, Perg., was imported from California for the control of red spider mite [*Tetranychus telarius*, L.]; the insects were immediately transferred to heavily infested carnations, but no sign of their increase was observed. Petroleum oil emulsions remain the standard insecticide for the control of the mite on roses and tomatos, but repeated applications of these sprays to cucumbers occasionally cause considerable leaf spotting accompanied by a serious hardening of the plants. In tests in a nursery in which cucumbers appeared particularly susceptible to infestation, only 4 out of 12 proprietary petroleum oil emulsions, sold for use on tomatos and cucumbers under glass, gave good control without causing visible injury after two applications. In preliminary experiments with two organic thiocyanates, concentrations that were lethal to the mites damaged roses, cucumbers and tomatos. In the absence of soft young growth, carnations appeared to be more tolerant, and good control was obtained with sprays containing 0·17 per cent. dodecyl thiocyanate and 0·2 per cent. of a product stated to be B. butoxy 6′ thiocyanodiethylether.

Infestation of ferns by *Pinnaspis aspidistrae*, Sign., and *Saissetia coffeae*, Wlk., was satisfactorily controlled by spraying the plants with, or immersing them in, a petroleum oil emulsion (0·8 per cent. oil) of the type used for spraying glasshouse plants against *T. telarius*. The plants (*Nephrolepis*, *Asplenium* and *Pteris*) were not affected by this treatment, but were damaged when fumigated with calcium cyanide at concentrations that were not lethal to the scales.

In experiments on the control of *Tyroglyphus putrescentiae*, Schr. (*longior*, Gerv.) in mushroom beds, dusts containing pyrethrum, derris and nicotine were ineffective, and a proprietary saline hypochlorite solution was not promising. Effective control was, however, obtained by scattering grade 16 pure naphthalene on spawned uncased beds in a commercial house, and the development of the mycelium was not affected. When the beds are being cropped, naphthalene injures young mushrooms and mature ones are tainted. Such beds may be fumigated between flushes by spreading it on the paths at the rate of 4 oz. per 1,000 cu. ft.

RUFFO (S.). **La Pieride del cavolo** (*Pieris brassicae* **L.**) **e la Pieride del biancospino** (*Aporia crataegi* **L.**).—*Circ. R. Oss. fitop. Inst. Ent. Univ. Bologna* no. 3, 8 pp., 1 pl. Bologna, 15th May 1938.

GOLFARI (R.). **La Carpocapsa delle mele** (*Carpocapsa* o *Cydia pomonella* (**L.**)) **e la Tignola del melo** (*Hyponomeuta padellus* **L.**).—*Op. cit.* no. 4, 12 pp., 2 pls. Bologna, 15th May 1938.

MARTELLI (M.). **La Piralide e la Sesamia del mais** (*Pyrausta nubilalis* **Hb.**, **e** *Sesamia cretica* **Led.**).—*Op. cit.* no. 5, 7 pp., 1 pl. Bologna, 30th May 1938. **La Mosca delle ciliege** (*Rhagoletis cerasi* **L.**) **e la Mosca delle frutta** (*Ceratitis capitata* **Wied.**).—*Op. cit.* no. 6, 11 pp., 4 figs. Bologna, 30th May 1938.

These circulars are designed to provide growers in Italy with practical accounts of the bionomics of the pests in question and measures for their control.

In slight infestations of cultivated crucifers by *Pieris brassicae*, L., it suffices to collect and destroy the eggs, larvae and pupae, but it is preferable to place larvae and pupae in cages to permit parasites to emerge. Sprays of lead arsenate or nicotine, both with the addition of soap, or dusts of calcium arsenate or barium fluosilicate are suggested if the attack is severe. The larvae of *Aporia crataegi*, L., sometimes cause considerable damage to the young shoots and leaves of apple and other fruit trees in spring. They are best controlled by destroying their winter nests before they leave them in March, but if this has not been done a lead arsenate spray or a calcium arsenate dust should be applied. A programme is given for six applications of a lead arsenate spray against *Cydia pomonella*, L., on apple, and the use of corrugated paper bands is explained. The insecticides recommended against the larvae of *Hyponomeuta padellus malinellus*, Zell., on apple are a lead arsenate spray, a calcium arsenate dust, or a spray containing nicotine sulphate and sodium carbonate.

The best measure against *Pyrausta nubilalis*, Hb., and *Sesamia cretica*, Led., is the collection of the infested maize stems [*cf. R.A.E.*, A **23** 521], which are best cut off underground, supplemented by the use of trap crops of early maize, sown before the main crop and destroyed in June or July, and by growing resistant varieties of maize.

Rhagoletis cerasi, L., is a serious pest of cherries in Italy [**20** 78, 318, 537]. The adults can be controlled by bait-sprays [**20** 538], or by suspending in the trees pans containing a bait of 3 per cent. molasses solution poisoned with 0·4 per cent. sodium fluoride or derris extract.

Against *Ceratitis capitata*, Wied., attacking *Citrus* and other fruits, trap-jars containing water in which bran has fermented [**23** 755] or bait-sprays of molasses solution poisoned with copper carbonate [**20** 130] are recommended.

MALENOTTI (E.). **Cento noterelle fitopatologiche.** [A hundred short Notes on Plant Pests and Diseases.]—Fscap 8vo, [4] 293 pp. Turin, G. B. Paravia & C., 1938. Price *Lire* 11.

The notes in this handbook are the text of a series of wireless broadcasts. Most of them deal with insects that infest economic plants in Italy, and some with insecticides.

MALENOTTI (E.). **Osservazioni sulle schiusure della piralide del mais.** [Observations on Emergence of Adults of *Pyrausta nubilalis*.]—*G. Agric. Domenica* no. 43 repr. 7 pp., 1 fig., 1 graph, 1 diagr. Rome, 24th October 1937.

MALENOTTI (E.). **Disinfestazione di steli di mais contro la piralide.** [The Disinfestation of Maize Stems against *Pyrausta nubilalis*.]—*Op. cit.* **48** no. 18 p. 157. Rome, 1st May 1938. (Sep. Publ. R. Oss. fitop. Veneto, 3 pp. Verona, 1938.)

In north Italy, the stems of maize must by law be destroyed by 30th April to kill the larvae of *Pyrausta nubilalis*, Hb., hibernating in them. As the stems are largely used for fuel, any advance in this date would entail hardship. In the first paper are recorded the dates of adult emergence observed in some parts of Venetia in 1934–37,

showing that in no instance did it occur before mid-May. Though emergence might possibly take place earlier in May after mild weather, the date of 30th April is quite safe.

In the second paper are given the results of experiments on fumigating maize stems so that they may be used for fences, roofs, etc., instead of being destroyed. After trials, a large scale test was carried out on 13th April in a silo of about 4,900 cu. ft. capacity at a temperature of 12°C. [53·6°F.]. A cartload of maize stems, half in bundles and half loose, was placed in the silo, which was sealed and fumigated for 48 hours with sulphur burned at four points, using it at the rate of 5 lb. per 1,000 cu. ft. After fumigation, all of 100 larvae from the loose stems were dead, while of 100 from the bundles, 11 survived and were still alive a week later. Submerging the stems in water for 8 days killed only 75 per cent. of the larvae in them.

MALENOTTI (E.). **Dure tappe nella lotta contro il " Verme " del pesco.** [Difficult Stages in Work against the Peach Moth.]—*Coltivatore* 1937 no. 21 repr. 5 pp. Casale Monferrato, 1937.

In view of a claim that larvae of *Cydia molesta*, Busck, in peach could be controlled by sprays containing rotenone, the author carried out investigations in Venetia in 1937 with two proprietary preparations containing 0·9 and 0·3 per cent rotenone, respectively, to ascertain whether satisfactory control could be obtained by the low concentrations that would be economically justifiable. The insecticides were applied to the trees 8 times between 28th May and 17th August as dusts and as suspensions in water, at the rate of nearly 2 lb. insecticide per tree, but the percentages of injured fruits gathered from treated trees were in all cases higher than those from trees from which infested shoots had been cut off.

MALENOTTI (E.). **Un passo avanti contro la** *Cydia molesta*. [A Step forward against *C. molesta*.]—*Atti Accad. Verona* (5) **15** pp. 227–230, 6 pls. Verona, 1937.

The destruction of the larvae of *Cydia molesta*, Busck, hibernating in baskets and boxes in which peaches are gathered or stored has been considered an indispensable measure of control in Italy [*R.A.E.*, A **25** 795]. Observations in 1937 in the province of Verona showed that adult emergence in store rooms began on 18th May, a month later than in the field [*cf.* **17** 90]. The store-room windows were shut to prevent the escape of the moths, which perished. Over 6,500 moths were collected in two stores. The rooms containing the fruit boxes and baskets need not be kept closed longer than from early May to 20th June. The moths die within 4 days at 25–29°C. [77–84·2°F.]. Owing to their strong attraction to light, it is sufficient to proof the windows and openings in well-lighted parts of the room ; the door may even be left open if it leads to a dark space. This method is to be made compulsory, and the author advises that fruit boxes should not have their surfaces smoothed, as cracks and irregularities attractive to the larvae for hibernation now become useful.

Deshusses (J.) & Poluzzi (C.). **Deux nouveaux foyers de** *Ceratitis capitata* **Wied. dans le canton de Genève.** [Two new Foci of *C. capitata* in the Canton of Geneva.]—*Mitt. schweiz. ent. Ges.* **17** pt. 5 p. 215. Berne, 15th March 1938. [Recd. July 1938.]

Ceratitis capitata, Wied., which was recorded from apricots growing near Geneva in 1935 [*R.A.E.*, A **24** 360], was observed in 1937 in two other localities in the same canton infesting peaches. Of the adults bred out, 60 per cent. were females. No parasites were found. One of the growers stated that he had observed larvae in his apricots in 1935.

Enser (K.). **Ueber ein Auftreten von** *Neomyzaphis abietina* **Walker in Oesterreich.** [On an Occurrence of *Rhopalosiphum abietinum* in Austria.]—*Neuheiten PflSch.* **31** pt. 3 p. 106. Vienna, June 1938.

Rhopalosiphum (*Neomyzaphis*) *abietinum*, Wlk., was observed on two spruce trees (*Picea engelmanni*) near Vienna ; it had not previously been recorded in Austria.

Pichler (F.). **Fusariumbefall auf San José-Schildläusen.** [*Fusarium* Infection of San José Scales.]—*Neuheiten PflSch.* **31** pt. 3 p. 106. Vienna, June 1938.

One individual of *Aspidiotus perniciosus*, Comst., collected in Styria and parasitised by Chalcidoids, was found also to be infested with a fungus of the genus *Fusarium*. A list is given of the six species of *Fusarium* that have been recorded in the literature as infesting this Coccid.

Ambros (W.). **Einige spezielle Beobachtungen und Untersuchungen der Nonnenkontrolle im Jahre 1937. Ein Beitrag zur Biologie der Nonne.** [Some special Observations and Investigations of the Nun Moth Watch in 1937. A Contribution to the Biology of the Nun Moth.]—*Zbl. ges. Forstwesen* **64** pp. 49–70, 1938. (Abstr. in *Neuheiten PflSch.* **31** pt. 3 p. 119. Vienna, June 1938.)

Lymantria monacha, L., completed its development in 63 days in the Svetla region, Czechoslovakia, in 1937. The first young larvae were seen on 8th May on the north side of a spruce trunk in a sunny position. The flight period lasted 59 days, with a peak in the first three weeks. Of pupae taken on trunks up to 10 ft. from the ground, 54 per cent. were males. Mating usually took place in the evening, and a male paired with only one female in a night. At 16°C. [60·8°F.], females laid all their eggs in 2–4 days. Wool or cotton wool left for 24 hours with an unmated female remained attractive to males for 3 days [*cf. R.A.E.*, A **16** 665]. Strips of jute about a foot wide, fastened breast-high round the trunks, proved effective for collecting larvae and pupae. Small birds sought the larvae under the bands.

Machatschke (J. W.). **Zur Biologie der Fichtenlärchengallenlaus** *Cnaphalodes strobilobius*. [A Contribution to the Biology of *Chermes strobilobius*.]—*Sudetendtsch. Forst- u. Jagdztg* **39** pp. 44–48, 6 figs., 1938. (Abstr. in *Neuheiten PflSch.* **31** pt. 3 p. 124. Vienna, June 1938.)

. Spruce and larch in North Moravia are attacked by *Chermes* (*Cnaphalodes*) *strobilobius*, Kalt. ; the fundatrices produce galls on the

shoots of spruce, and the larvae of the summer generation (aestivales) cause the needles of larch to bend over. Control is effected by means of adhesive banding or sprays of kerosene emulsion or tobacco extract and soft soap.

HENNIG (W.). **Uebersicht über die Larven der wichtigsten deutschen Chrysomelinen (Coleoptera).** [A Review of the Larvae of the most important German Chrysomelid Beetles.]—*Arb. physiol. angew. Ent. Berl.* **5** pt. 2 pp. 85–136, 52 figs., 2 pls. Berlin, 6th July 1938.

This paper comprises a discussion of the characters of value in the identification of the larvae of Chrysomelids (*sens. strict.*) and descriptions of the larvae of over forty of the commoner German species, with keys to the genera and species.

GÖSSWALD (K.). **Ueber Empfindlichkeitsunterschiede einiger Ameisenarten gegen Arsen-Frassgifte.** [On Differences in Sensitivity of some Species of Ants to Arsenic Stomach Poisons.]—*Arb. physiol. angew. Ent. Berl.* **5** pt. 2 pp. 137–154, 9 refs. Berlin, 6th July 1938.

Laboratory tests with several species of ants occurring in Germany were made with two proprietary arsenical baits. Toxicity was measured by percentage mortality and the average time required for death. The different ants showed a very great diversity in susceptibility and the differences between races of a given species were sometimes greater than between species of different genera. These differences were most marked with the less toxic of the two baits.

The author points out that the choice of an insecticide is not merely conditioned by the absolute physiological sensitivity to poison, but also by the habits of the species, and whilst a poison bait may be effective in one case, different means of control may be required against the same species in a different environment.

SPEYER (W.). **Die Lebensdauer der Frostspanner-Falter (*Cheimatobia brumata* L.) unter dem Einfluss von Begattung und Eiablage.** [The Effect of Pairing and Oviposition on the Duration of Adult Life in the Winter Moth, *Operophtera brumata*, L.]—*Arb. physiol. angew. Ent. Berl.* **5** pt. 2 pp. 155–165, 8 refs. Berlin, 6th July 1938.

The following is chiefly taken from the author's summary: During his investigations on *Operophtera* (*Cheimatobia*) *brumata*, L., in Germany [*cf. R.A.E.*, A **26** 420], the author found that the longevity of the males varied considerably, the observed maximum being 35 days. It did not appear that pairing once had any effect on the duration of life, or even that repeated pairings led to a more rapid exhaustion of vitality. Both males and females caught in the field seemed in general to have greater vitality than those bred from the egg in the laboratory. Many fertilised females lived for 25–33 days and one lived for 64, while 33–36 days must be regarded as the maximum for unfertilised females. Females could be fertilised at least three times, but the males distinctly preferred unfertilised ones. Besides the eggs already mature when the female emerges from the pupa, others are

probably matured and laid. The remaining immature eggs and the egg germs in the ovaries degenerate in very old females (fertilised or unfertilised) and appear to serve to prolong life, as no feeding occurs.

Notes are also given on instances observed of malformation of the wings of males and the genital organs of females and of contamination with bacteria of the bursa in paired females, and the causes and effects of these are briefly discussed.

Schuch (K.). **Laboratoriumsuntersuchungen über den Lebensablauf des Maikäfers** (*Melolontha melolontha* **L.).** [Laboratory Investigations on the Life-history of *M. melolontha*.]—*Arb. physiol. angew. Ent. Berl.* **5** pt. 2 pp. 166–177, 2 figs., 25 refs. Berlin, 6th July 1938.

In laboratory experiments at Kiel, glass cylinders inverted on pots of earth were used as cages for individual pairs of adults of *Melolontha melolontha*, L. Young twigs of favourite food-plants standing in glass tubes filled with water were placed in the cages and renewed every second day.

The following is taken from the author's summary : Of 20 females, 7 oviposited once, 4 twice, 6 three times, and 3 four times. The average numbers of eggs was 28·8 for the first oviposition, 21·8 for the second, 19·8 for the third, and 13 for the fourth. The number of eggs per female varied from 24 with a single oviposition to 91 with four ovipositions, and the average was 53·9. The average incubation periods were 13, 11, 8 and 12 days for eggs deposited in the first, second, third and fourth ovipositions, respectively. At the time of oviposition the females remained in the ground for 1–6 days, with an average of 2 days for the first oviposition and rather longer for the succeeding ones. The females lived for 20–63 days, the average being 39. The number of ovipositions and the total number of eggs increased with longer life. The life of the males was rather shorter than that of the females. Captivity did not appear to have any effect on the beetles.

Schmidt (H.). **Einige an Kulturpflanzen schädlich auftretende Blatthornkäfer.** [Some Lamellicorn Beetles injurious to cultivated Plants.]—*Kranke Pflanze* **15** pt. 7–8 pp. 123–126. Dresden, 1938.

Brief notes, partly from the literature, are given on several Lamellicorns that occasionally injure economic plants in Germany, and the adults are described. They include *Anomala* (*Phyllopertha*) *horticola*, L. [*cf. R.A.E.*, A **15** 515 ; **22** 212], *Anisoplia segetum*, Hbst., the adults of which infest the ears of cereals and were observed in 1937 in rye, occurring mainly at the edges of the fields, *Amphimallus* (*Rhizotrogus*) *solstitialis*, L., of which the adults feed on the leaves of various trees, including poplar and willow, and the larvae on the roots of grasses, cereals, potato, beet and garden plants, and *Cetonia aurata*, L., the adults of which are occasionally harmful to the flowers of roses and fruit trees. Observations on the larvae of *C. aurata* are quoted [**22** 267] ; its life-cycle lasts 1–2 years, but the other species complete their development in a single year, except perhaps in the coldest parts of Germany.

MAGERSTEIN (V.). **Die Schmuckwanze als Rapsschädling.** [*Eurydema ornatum* as a Pest of Rape.]—*Kranke Pflanze* **15** pt. 7–8 pp. 126–130, 1 pl. Dresden, 1938.

Rape is being increasingly cultivated in Czechoslovakia, and in view of the fact that infestation of it by *Eurydema ornatum*, L., is also increasing, laboratory and field observations on the bionomics of this Pentatomid were carried out in the district of Prerau, where it caused crop losses of 20–35 per cent. in 1937. All stages are described. The adults migrate in late spring from their winter quarters to wild crucifers in blossom, varieties with rough hairs and a pungent taste being avoided. When these plants have finished blooming, they fly to the rape fields and pair. Females deposit about 60 eggs, which are highly resistant owing to their wax-like coating, in batches of about 6, on the siliquae, stems, and stem leaves of rape, and on weeds and small stones. The nymphs hatch in 6–8 days and become adult after 5 moults, which occur at intervals of 12–20 days. They gradually descend the plants and in the fifth instar abandon the rape and complete their development on other crucifers. The adults leave these in late autumn without pairing, and overwinter in sheltered situations. The punctures in the stalks of the blossoms and siliquae cause them to turn yellow and wither. As the flowering of rape proceeds, the bugs attack the growing siliquae, the juicy stems and the lateral leaves on the upper part of the stems. Nymphs and adults on plants that are being threshed are crushed by the rollers and give the rape seed a disagreeable smell. The nymphs can be destroyed by ploughing the rape stubble immediately after harvesting ; since they were shown to be susceptible to calcium cyanamide, kainit and lime, one of these might also be ploughed in. The growth of self-sown rape should be prevented by harrowing. Early flowering varieties of rape are less attacked.

LEIB (E.). **Ein beachtenswerter Pfirsichschädling.** [A Peach Pest worthy of Notice.]—*Kranke Pflanze* **15** pt. 7–8 pp. 134–135. Dresden, 1938.

In July 1937, *Anarsia lineatella*, Zell., was found to be infesting peach severely in the district of Saarbrücken, causing a crop loss of 80 per cent. in two localities. The larvae hibernate in cocoons in shelters hollowed in the bark in forks of the branches. Early in March they bore into the fruit spurs and cause them to wither. Pupation occurs in shelters in the bark at the end of April, and the moths emerge 10–12 days later and oviposit on the young shoots. The larvae of the summer generation hatch in mid-May, bore into the shoots and then attack the young fruit. They pupate in July and August, mostly on the fruit. The adults, which emerge after about a week, oviposit chiefly on the edge of the hollow where the peduncle is attached, and the larvae, which overwinter, hatch in 6–8 days. Infested shoots should be collected repeatedly in spring and burnt. A 5–10 per cent. lime-sulphur spray, applied when the buds are swelling, is useful, and another application is desirable before blossoming. Post-blossom sprays of lead arsenate and winter sprays of tar distillate are also said to be effective. Infested fruits should be picked before they fall. *A. lineatella* also attacks apricots, plums and damsons.

Laubert (R.). **Ein neuer Obstbaumschädling.** [A new Fruit-tree Pest.]—*Kranke Pflanze* **15** pt. 7–8 pp. 138–139. Dresden, 1938.

The author states that in the second half of May 1938 he observed adults of *Tanymecus palliatus*, F., feeding on the leaves of apple in an orchard in the Ruhr district. So far as he is aware, this is the first record of the weevil attacking fruit-trees.

Amtliche Pflanzenschutzbestimmungen. [Official Regulations on Plant Protection.]—*Beil. NachrBl. dtsch. PflSchDienst* **10** no. 5 pp. 97–119. Berlin, 1st July 1938.

This part includes the text of a Prussian regulation dated 8th April 1938 against the caraway moth [*Depressaria nervosa*, Haw.] requiring the application of dust insecticides of a composition and at a time to be prescribed by authority, the threshing of the caraway immediately it is cut, and the immediate burning of the straw, and prohibiting the storage of unthreshed caraway.

Die ersten diesjährigen Kartoffelkäferfunde an der Westgrenze. [The first Records in 1938 of the Potato Beetle on the western Frontier of Germany.]—*NachrBl. dtsch. PflSchDienst* **18** no. 7 pp. 58–60, 1 map. Berlin, July 1938.

Germany : First Records of the Colorado Beetle (*Leptinotarsa decemlineata*) **in 1938.**—*Int. Bull. Plant Prot.* **12** no. 8 p. 169M. Rome, August 1938. **Belgium : The Colorado Beetle in 1938.**—*T.c.* p. 170 M.

Between 1st and 13th June 1938, following stormy south-west winds, *Leptinotarsa decemlineata*, Say, was found in 82 localities in western Germany [*cf. R.A.E.*, A **26** 418], 27 of the records being from places other than potato fields and many of them referring to only single individuals. A list of the localities is given in the first paper. Between 31st May and 8th June 1938 and at several subsequent periods, considerable swarms of *L. decemlineata* coming from the south were reported in Belgium.

Judenko (E.). **Jeden ze sposobów wiosennego zwalczania pleszki chmielowej.** (*Psylliodes attenuata* **Koch**). [A Measure for the Control in the Spring of the Hop Flea-beetle (*P. attenuata*, Koch).] *Życie roln.* 1938 repr. 8 pp., 2 figs., 2 refs. Warsaw, 1938.

Psylliodes attenuata, Koch, has one generation a year in Poland and feeds on hops, hemp, and nettles (*Urtica dioica*). The overwintered adults appear about mid-April on wild hops and nettles growing near cultivated hops, and attack the young shoots of the latter as soon as they appear. Females oviposit in the soil in the second half of May and June near the hops, on the roots of which the larvae feed. Young adults emerge during the whole summer and feed on the leaves and cones of the hops, often until the middle of October. Catching the adults in spring between two shallow cones 8 ins. high and 16 ins. in diameter, made of cardboard and covered inside with an adhesive, has proved very effective in reducing infestation. The two cones are held on either side of the infested plant and are then brought together quickly so as to enclose it ; the flea-beetles are disturbed by the darkness and jump on to the sticky surface.

In the case of larger plants, the cones should be applied first to the upper and then to the lower part. The best time for using them is on sunny and warm days, when the flea-beetles are most active. The operation should be repeated some 15 times during the season, beginning with the first appearance of the flea-beetles on the hops. About 21,000 were caught from 324 hop plants in Pulawy in 1937, the cones being applied 13 times to each plant. The beetles from 300 plants, each 4–12 ins. high, could be caught in about half an hour. Wild hops and neetles growing near cultivated hops should be uprooted or cut down, and if they are infested with flea-beetles the latter should first be caught.

Judenko (E.). **Przyczynek do poznania skuteczności i opłacalności zwalczania bielinka kapustnika** (*Pieris brassicae* **L.**). [Contribution to the Knowledge of the Effectiveness and economic Practicability of controlling *P. brassicae*.]—*Roczn. Ochr. Rośl.* **5** fasc. 6 repr. 14 pp., 6 refs. Warsaw, 1938. (With a Summary in German.)

An account is given of experiments in Poland to determine whether the expense of crushing the eggs and newly hatched larvae of *Pieris brassicae*, L., on cabbage is economically justifiable. Of the eggs laid on cabbage in a kitchen garden, 74 per cent. were on the lower surface of the leaves [*cf. R.A.E.*, A **18** 236]. From 1st July to 13th September, 2,190 egg-batches were laid on 93 cabbage plants in experimental plots, the peak of oviposition occurring between 4th and 27th July. The numbers of eggs in sample batches varied from 7 to 145, with an average of 42. Some of the batches disappeared from the plants, possibly being destroyed by predators. Of 1,213 eggs taken to the laboratory during July, none was parasitised, though 8·8 per cent. did not hatch. In the field, at temperatures varying from 17 to 21°C. [62·6–69·8°F.], the egg stage lasted 4–9 days, with a mean of 6. The shortest period during which newly hatched larvae lived gregariously was about 40 hours. Between 1st and 27th July, all the 93 cabbage plants on the experimental plots were examined 6 times, and the eggs and larvae found on them were crushed. In all, 2,063 batches of eggs and 23 groups of young larvae were thus destroyed in a total period of 11 man-hours. At the end of September, the cabbages in the treated plots were 36 per cent. heavier than those in untreated ones, and their average diameter was 11 per cent. greater. Based on the market prices obtaining, the cost of treatment was considerably less than the loss on untreated plants.

[Vukasović (P.).] **Вукасовић (П.). Contribution à l'étude de** *Polychrosis botrana* **Schiff.** [*In Serbian.*]—*Arh. Min. Pol'oprivr.* **5** no. 10 repr. 14 pp., 1 fig., 1 graph., 8 refs. Belgrade, 1938. (With a Summary in French.)

Polychrosis botrana, Schiff., has spread south of Smederovo since 1929 [*R.A.E.*, A **20** 664] and is now established in all the vineyards in Serbia. Its occurrence has, however, been very erratic ; outbreaks begin or cease suddenly, and unexpectedly large numbers of adults or larvae have appeared, apparently without cause. In an attempt to explain these phenomena, the author dissected newly emerged females. The number of distinct oöcytes in the ovaries was about 140, but of these only about 40 were in a sufficiently advanced stage of development to give rise to mature eggs that would be deposited. This number

depends on a complex of internal and external factors, including larval feeding, and is subject to considerable variation.

Observations on the emergence of moths in spring were carried out in 1932–33 ; 320 pupae, obtained from larvae on infested grapes that pupated between 11th September and 6th October, were kept under identical conditions of temperature and humidity, and the numbers of adults that emerged were counted daily. The period of emergence lasted from about the beginning of February till the middle of June, during which time 228 moths were obtained. There were two definite peaks of emergence, one occurring about the middle of March, and the other in the second half of May. Similar protraction and peaks of adult emergence occur in nature, giving an appearance of distinct generations, and the author suggests that the overwintering generation of *P. botrana* may consist of both heterodynamic and homodynamic individuals [*cf.* B **11** 55], with transitional forms. Of the moths that emerged in the laboratory, about 50 per cent. were homodynamic and 15 per cent. heterodynamic.

KORNFELD (A.). **Schutz wertvoller Kulturen vor Engerlingfrass.** [The Protection of valuable Crops against Lamellicorn Larvae.]—*Anz. Schädlingsk.* **14** pt. 7 pp. 73–77, 2 figs., 5 refs. Berlin, 15th July 1938.

The larvae of *Melolontha melolontha*, L. (*vulgaris*, F.) cause considerable injury in vineyards in the Mediasch region of Rumania, and large sums are spent for their collection. The adults appear in numbers every fourth year and fly in the evening for about 20 minutes over the Kokel valley from mixed woods, chiefly beech, to oak woods, returning after 60–90 minutes. During the outward flights, many of the females alight in the valley to oviposit, boring into the ground to a depth of 6–8 ins. and laying 8–30 eggs. Counts of young larvae showed that fewest eggs are laid in pastures with a hard surface, and fewer in plough land than in low-lying river meadows, the respective proportions in a given area being 36·7, 81·3 and 100.

Experiments on methods of preventing oviposition are described. Covering the ground with oiled paper was the most effective, but can only rarely be employed. Rolling, especially with a smooth roller, was also effective, but renders the soil unsuitable for cereals and most other crops in dry districts, as it is thereby deprived of water through capillarity. This method was, however, a practical success with soy beans [*R.A.E.*, A **24** 80], causing a reduction of 66 per cent. in the number of plants destroyed by the larvae. In tests of repellents, strips of sacking soaked in carbolic acid and laid, weighted with stones, at intervals on the ground gave varying results, but on some plots afforded considerable protection. Paradichlorobenzene applied 3 times in the course of 16 days by scattering it on the soil at the rate of 3 oz. per 100 sq. yards considerably reduced oviposition, and its use might be economic in vine nurseries.

Aperçu sur l'extension des insectes nuisibles et des maladies des arbres dans les forêts domaniales de Lettonie en 1936/37. [*In Lettish.*]—*Statist. for. Lettonie* **10** repr. 15 pp. Riga, 1938. (With a Summary in French.)

This report includes notes by L. Brammanis on 36 species of insect pests observed on trees in forests in various districts in Latvia in

1936–37. The chief damage was that caused to deciduous trees by *Melolontha hippocastani*, F., the flight of which occurred in 1936, and to pines by *Hylobius abietis*, L. [*cf. R.A.E.*, A **26** 90]. In the most severely infested localities, the cockchafers were shaken off the trees and destroyed, and for the control of the weevil trap ditches were dug to separate felled from restocked areas.

QUAYLE (H. J.). **Insects of Citrus and other Subtropical Fruits.**—Med. 8vo, xi+583 pp., 377 figs. Ithaca, N.Y., Comstock Pubg Co., Inc., 1938. Price $5·00.

This work deals with the pests of *Citrus* and avocado in various parts of the world and with those that attack the grape-vine (*Vitis vinifera*), walnut, almond, pecan, fig, olive, date, oriental persimmon, pomegranate and sweet cherry, chiefly in the United States. The opening chapter is a review of characters and distribution of the fruits concerned, the extent to which they are cultivated and the important insects or groups of insects that attack them ; it includes a key to the principal insects and mites attacking *Citrus* in the United States. Of the next 14 chapters, three are devoted to the pests of citrus, nine to the pests of the other fruits, one to the insects predacious and parasitic on such pests and one to the rodents, Nematodes and snails attacking *Citrus*, etc. The control of the pests by tent fumigation, spraying and dusting is then discussed in some detail and, in conclusion, a summary is given of the relevant plant quarantine laws in the United States. Bibliographic citations are given throughout as footnotes and there is a general index.

BROWN (H. B.). **Cotton. History, species, varieties, morphology, breeding, culture, diseases, marketing, and uses.**—2nd Edn, Demy 8vo, xiii+592 pp., frontis., 140 figs. New York & London, McGraw-Hill, 1938. Price 30*s*.

Although some mention is made of cottons in other countries and the conditions under which they are grown, the material presented in this text book mainly applies to the upland cotton district of the American cotton belt. One chapter (pp. 338–376, 18 figs.) deals with the bionomics and control of the principal pests of cotton in the United States.

DUNLAP (A. A.) & TURNER (N.). **Vegetable Pest Control Schedule.**—*Circ. Conn. agric. Exp. Sta.* no. 121 pp. 27–49. New Haven, Conn., March 1938.

Tabulated programmes are given for treatments against pests and diseases of vegetables in Connecticut, together with brief notes on the preparation of the insecticides and fungicides recommended and on the identification of the insects and fungi against which they are used.

BRITTON (W. E.). **Connecticut State Entomologist, Thirty Seventh Report 1937.**—*Bull. Conn. agric. Exp. Sta.* no. 408 pp. 133–266 and xi-xvi, 23 figs., many refs. New Haven, Conn., May 1938.

An annotated list is given by Britton (pp. 138–152) of insect pests observed in Connecticut in 1937, and work in the campaign against

the gipsy and brown-tail moths [*Lymantria dispar*, L., and *Nygmia phaeorrhoea*, Don.] is reported by Britton, J. T. Ashworth & O. B. Cooke (pp. 171–179). In a section on *Pyrausta nubilalis*, Hb. (pp. 180–184), Britton, N. Turner & M. P. Zappe state that infestation of dahlias by it was the greatest on record. On 2nd, 9th, 16th and 25th August, and 1st, 8th and 15th September, dahlias were treated with sprays of nicotine tannate or 1 lb. cubé (4 per cent. rotenone) in 25 U.S. gals. water with a suitable spreader, or dusts of a dual-fixed nicotine (4 per cent. nicotine) [*cf. R.A.E.*, A **25** 770] or cubé (1 per cent. rotenone). All gave satisfactory control, but the cubé spray was rather less effective than the other treatments. On early and late maize, however, the cubé spray and a similar one made with derris were slightly more effective than the nicotine dust, though the latter gave a high degree of protection. In 1935, 1936 and 1937, maize maturing during August was, with few exceptions, less heavily infested than that maturing in July or September [*cf.* **26** 14]. Damage, especially that caused by the second generation, was most severe in 1937. J. P. Johnson & P. Garman record (pp. 185–191) that *Popillia japonica*, Newm., continued to spread [*cf.* **26** 14]. Parasites liberated for its control in 7 localities in 1936 and 1937 comprised 1 colony of *Centeter cinerea*, Aldr. (in 1937), 6 of *Tiphia popilliavora*, Rohw., and 8 of *T. vernalis*, Rohw. *C. cinerea* oviposited abundantly after liberation but is not known to have become established. *T. vernalis* was recovered in May 1937 in 2 out of the 4 districts in which it had been liberated in 1936.

Britton reports (pp. 191–200) that an outbreak of *Cirphis unipuncta*, Haw., on grasses, clover and cereals affected at least 6 counties and was the most serious since 1914 [**3** 370]. There are at least two generations annually in Connecticut, and probably a partial third which is, perhaps, sometimes complete. Records of the capture of the moths in early May suggest that the winter is passed in the adult or pupal stage. Females deposit up to 700 eggs, in clusters of up to 50, in the sheath or at the unfolded base of a blade of a grass or cereal. Pupation takes place 1–2 ins. below the surface of the soil. The egg, larval and pupal stages last 8–10, 20–30 and 10–15 days, respectively. The moths, which usually remain hidden during the day, are attracted slightly by lights and strongly by sweetened baits and decaying fruit. In most seasons, the larvae feed on weeds and grasses in swamps, low meadows and uncultivated land. When an outbreak occurs they migrate in large numbers and do considerable damage. The most important parasites in Connecticut are the Tachinids, *Winthemia quadripustulata*, F., and *Belvosia unifasciata*, R.-D., and the Braconid, *Apanteles militaris*, Walsh. In addition to control measures already noticed [**24** 155], barriers may be formed of dried straw, which is burned when a sufficient number of larvae have sheltered under it.

Zappe & E. M. Stoddard (pp. 200–205) give an account of continued investigations on sprays for apples [*cf.* **26** 15]. When varieties resistant to scab were sprayed with a mixture of 3 lb. lead arsenate, 10 lb. lime, and 1 U.S. quart fish-oil in 100 U.S. gals water, good control of *Cydia* (*Carpocapsa*) *pomonella*, L. and *Conotrachelus nenuphar*, Hbst., was obtained. Zappe (pp. 205–207) reports that *Chionaspis pinifoliae*, Fitch, has become very abundant on pines throughout Connecticut in the last few years. The overwintered eggs hatch in the latter part of May, and those of the summer generation in late July or early August. As contact sprays against the crawlers [**26**

270, 549] are effective only if correctly timed, experiments were carried out with dormant sprays that could be applied at any time between the autumn and early spring. Liquid lime-sulphur (1 : 9) was more than twice as effective as any of a number of oil sprays, and gave approximately 100 per cent. control. The needles were somewhat discoloured and the spray remained visible for some time. All the oil sprays reduced infestation and none of the sprays caused noticeable injury to the pines, even when applied after the new growth had started.

Turner & Zappe (pp. 208–217) describe 33 cases of infestation of buildings by termites. When shielding was used [**17** 730] it gave complete protection except in two cases in which termites dropped tubes down over shields soon after installation ; in instances in which its application would have been uneconomic, chemical treatments involving wood impregnation gave satisfactory results.

A series of papers by Garman (pp. 219–228) deals with the control of orchard pests. In further investigations on the infestation of apple by *Paratetranychus pilosus*, C. & F., the numbers of winter eggs in twig counts after leaf fall were 60 on a plot treated with lime-sulphur up to the calyx spray and receiving no applications of oil, 14–29 on two plots sprayed with oil followed by flotation sulphur and 1 on a plot receiving neither oil nor sulphur. In almost all cases in which sulphur sprays were applied, there was a marked reduction in the predators of the mite [**26** 15]. Three of the more important predators, *Seius*, *Scolothrips* and *Stethorus punctum*, Lec., overwinter on the bark of the larger branches and trunk. In a series of tests, thrips were almost completely removed by sprays of tar oils but were not seriously reduced by other oils. In 1936, the percentages of fallen peaches that were infested by *Conotrachelus nenuphar* were 36 from trees sprayed with cryolite, 33 from those sprayed with standard acid lead arsenate mixed with zinc sulphate, and 70 from unsprayed trees. In 1937 the following materials, all in 100 U.S. gals., were applied twice, on 27th–29th May and 12th June : 4 lb. natural cryolite and 2 lb. hydrated lime mixed at the first application with 10 lb. flotation sulphur paste and 1 U.S. pint fish oil, and at the second with 5 lb. magnetic wettable sulphur and $\frac{1}{4}$ lb. casein waterproof glue ; a mixture of 3 lb. basic zinc arsenate, 3 lb. hydrated lime, 1 lb. zinc sulphate and 10 lb. flotation sulphur paste ; and a mixture of lead arsenate (2 lb. in the first spray and 3 lb. in the second) with 4 lb. zinc sulphate, 6 lb. hydrated lime and 10 lb. flotation sulphur. The percentage infestations after these sprays were, respectively, 11, 48·5 and 24·0, as compared with 50·5 in the control. About twice as many parasites of larvae of *Cydia* (*Grapholitha*) *molesta*, Busck, were liberated in peach orchards in 1937 as in 1936 [*cf.* **26** 16]. The total of 61,789 comprised some thousands each of *Microdus* (*Bassus*) *diversus*, Mues., *Macrocentrus ancylivorus*, Rohw., *Phaeogenes haeussleri*, Uch., and *Angitia* (*Dioctes*) *molestae*, Uch., and 391 of *Orgilus longiceps*, Mues. Band collections in 3 different orchards in the centre of the state showed that *Macrocentrus* was still the most numerous of the parasites, which were generally scarce in 1936 and 1937 in spite of mild winters. This may be due partly to the abundance of *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.), which is both a primary and a secondary parasite ; its direct effect on infestations of *C. molesta* in the field is not known. *Angitia molestae* overwintered successfully and was recovered in 5 localities ; *Microdus diversus* was also recovered, but there is no evidence that it survived the winter. *A. molestae* increased rapidly in

numbers after liberation ; in one orchard of about 2 acres in which 200 females were first released on 30th June, the percentages of larvae parasitised by it on 7th, 14th and 21st July were, respectively, 11, 51 and 39. A list is given of the larval parasites recovered from 27 orchards throughout the state ; the percentage parasitism averaged 20·2, and there was a general correlation between parasitism and the percentage of sound fruit in samples collected at the end of the season. No significant reduction in the infestation of peaches by *C. molesta* was produced by three applications in August of sprays of a fixed nicotine or of cubé alone or with Ultrawet spreader [**26** 285].

Trichogramma egg-parasites have been released in large numbers in Connecticut since 1929 and have noticeably reduced the population of *C. molesta* under some conditions, but their ability to survive the winter has been uncertain. After the severe cold of 1933–34 and 1934–35, investigations, described by G. R. Smith and Garman (pp. 228–230), were therefore undertaken to ascertain whether they had survived in the orchards of southern Connecticut. At the end of May 1935, when the average temperature was 77°F., and the relative humidity 54 per cent., 15 cards of eggs of the grain moth [*Sitotroga cerealella*, Ol.] were hung throughout an orchard where no liberations had been made since 1933. Two days later 7 females of *Trichogramma* were collected on the cards. They were considerably larger and darker than those reared under laboratory conditions. All the exposed cards showed signs of parasitism after 4 days. Similar tests in 5 other orchards, in 3 of which sprays were applied during the times of exposure, gave comparable results, but showed that the spraying apparently somewhat reduced the activity of the females.

Garman and J. F. Townsend (pp. 230–232) report very effective control of *Rhagoletis pomonella*, Walsh, on apple trees that had been sprayed with lime, lead arsenate and fish oil or flotation sulphur until the middle of June, by 3 applications of 0·5 per cent. rotenone dust in a clay carrier in July. Cage observations showed that oviposition begins about 10 days after emergence, reaches a maximum in 4–11 days and continues for 3 weeks or more. The peak of emergence is often reached about 20th July, and late applications of dusts are probably advisable for the control of flies ovipositing from 7th to 10th August.

B. J. Kaston gives a list (pp. 235–242) of the insects and mites that breed in or feed on elms in Connecticut. R. L. Beard (pp. 243-248) describes experiments on the control of *Anasa tristis*, DeG., on squash in which the insecticides were applied on 20th and 30th July and 13th August. Dry Pyrocide [*cf.* **25** 553], which is a kerosene extract of pyrethrum carried by diatomaceous earth and contains 2 per cent. pyrethrins, was mixed with talc, 1 : 9; a concentrated kerosene extract of pyrethrum (2·4 per cent. pyrethrins) was emulsified with Ultrawet [**26** 285] and water at the rate of 2 : 1 : 1,000 ; and a proprietary extract of pyrethrum together with an emulsifying agent was used at a dilution of 1 : 200. The percentages of nymphs and adults killed by the treatments in July averaged, respectively, 69·5, 82·9 and 64·9. The total yield on these plots and on another on which the eggs were carefully removed by hand at 10-day intervals from 9th July, were, respectively, 260, 350, 324 and 233 lb. as compared with 276 lb. from a control plot. The differences are, however, probably due not only to *Anasa tristis*, but also to a number of other factors, of which perhaps the most important is damage by the squash vine borer, *Melittia satyriniformis*, Hb.

Production from all the treated plots lasted for at least a month longer than from the untreated plot. In recommendations for control, it is pointed out that whereas numerous applications of dust are necessary against the adults early in the season [**25** 553] only 3 treatments with the kerosene extract spray are required against the nymphs. The first eggs hatch during the first week in July, and the spray should be applied about the beginning of the 3rd week, when most of the nymphs will be in the first three instars, and repeated after intervals of 10 and 10–14 days. The proprietary spray should be applied 4 times at 10-day intervals from mid-July. Directions are given for mixing the sprays. Talc is preferable to sulphur or gypsum as a carrier for the dust, which is less effective than the sprays but easier to apply.

J. A. Manter (pp. 248–249) states that a colony of *Magicicada septendecim*, L., appeared over an area of about 10 acres in one locality. This is considered to be a remnant of brood XI [*cf.* **25** 558]. The cicadas were first heard on 5th June and 2 days later many thousands were present. Oviposition began within 7 days, and by the end of the second week injury to certain trees was conspicuous. A list is given of the trees and bushes in which egg punctures were found. On 22nd June, 90 newly emerged adults were collected in an hour, but 2 days later they were very scarce and no living ones were found after this date. The nymphs hatched during August and entered the ground.

Miscellaneous pests on which notes are given by several of the above authors (pp. 252–262) include *Anobium punctatum*, DeG., which severely damaged a floor of pine wood [*cf.* **26** 17]; *Ochrosidia villosa*, Burm., the larvae of which infested lawns in 3 localities [*cf.* **20** 701]; *Protoparce quinquemaculata*, Haw., which, together with smaller numbers of *P. sexta*, Joh., attacked tobacco in the Connecticut River Valley, where the infestation of suckers after harvest was considered by some growers to be the worst for 43 years; *Aegeria* (*Conopia*) *exitiosa*, Say, which caused a loss of 10–30 per cent. over a nursery field containing 125,000 peach trees; and *Diabrotica longicornis*, Say, which was reported to be causing some damage to ears of maize in one locality. Adults of *Nacerda melanura*, L., appeared in hundreds in a clothing store in New Haven; unless the larvae had developed beneath the concrete basement floor there was apparently insufficient damp wood for the development of such a large population.

Britton (W. E.) & Johnson (J. P.). **The Japanese Beetle in Connecticut.**—*Bull. Conn. agric. Exp. Sta.* no. 411 pp. 455–486, 16 figs., 15 refs. New Haven, Conn., June 1938.

This paper contains a brief survey of the history of the establishment of *Popillia japonica*, Newm., in the United States and in Connecticut. All stages are described and an account is given of its bionomics, the injury caused by the adults and larvae, and biological and other methods of control. It first appeared in Connecticut in 1926 [*R.A.E.*, A **15** 500]; it now occurs in all the cities and larger villages of the state and has caused considerable damage, but has not become established in country districts. Its life-cycle is very similar to that recorded in New Jersey [**13** 338]. Attempts are being made to introduce three of its parasites into Connecticut. Of these, *Centeter cinerea*, Aldr., was released there in 1928 and 1929, but in both cases failed to become established. Females of *Tiphia vernalis*, Rohw., were released in May 1936 and some recoveries were made in 1937;

females of *T. popilliavora*, Rohw., were released in September 1937 [see preceding abstract].

The chief measures employed against the adults are traps and repellent sprays [*cf.* **22** 633, etc.], but large numbers can often be destroyed by jarring them from trees or shrubs on to a sheet of canvas. Treatment of turf with lead arsenate [**25** 37, etc.] is the principal measure employed against the larvae. The provisions of the Federal Quarantine against *P. japonica* are briefly reviewed [*cf.* **25** 628; **26** 384, etc.].

HADLEY (C. H.). **Progress of Japanese Beetle Investigations.**—*J.N.Y. ent. Soc.* **46** no. 2 pp. 203–216, 27 refs. New York, N.Y., June 1938.

This is a review from the literature of investigations on the control of *Popillia japonica*, Newm., in the United States up to 1936.

WATSON (J. R.) & others. **Entomology.**—*Rep. Florida agric. Exp. Sta. 1936–37* pp. 70–74. Gainesville, Fla. [1938.]

Some of the work on pests in Florida mentioned in this report for 1936–37 has already been noticed [*R.A.E.*, A **26** 64, 131, 217]. The Florida flower thrips, *Frankliniella cephalica bispinosa*, Morg., was again scarce on *Citrus* [*cf.* **25** 624]. As the blossom period was unusually prolonged, sprays directed solely against the thrips could not be used; lime-sulphur reinforced with wettable sulphur at the rate of 10 lb. per 100 U.S. gals. spray gave some control, and this was improved by the addition of nicotine sulphate. Winter-flowering weeds should be destroyed. Fair control of the thrips on chrysanthemum was given by a bait of molasses with Paris green, and also by sprays containing an aliphatic thiocyanate (lethane [*cf.* **24** 731] with lethane spreader), which caused injury only to plants fully exposed to the sun. Chrysanthemums and roses should be kept at a distance from ornamental annuals that bloom a month or so earlier.

The Coccinellid, *Leis dimidiata*, F. ab. *quinquedecimspilota*, Hope, was unable to control *Aphis spiraecola*, Patch, which was unusually abundant on *Citrus* owing to warm weather in January. The papaya whitefly [?*Trialeurodes variabilis*, Quaint.] was the only food, apart from Aphids, on which *L. dimidiata* was observed to breed, and the larvae of the latter were killed and the adults driven off when the papayas were dusted with sulphur to control the Aleurodid. Important supplementary foods of the Coccinellid in summer, when Aphids are scarce, were afforded by the honeydew from *Peregrinus maidis*, Ashm., and by *Crotalaria striata* [*cf.* **22** 693], but apparently only when it was planted in thick stands. *Nezara viridula*, L., was unusually scarce on *Citrus* in the autumn of 1936, and this is attributed to the fact that parasitism by *Trichopoda pennipes*, F., had been about 50 per cent. in previous years [*cf.* **25** 644]. The percentage parasitism was about the same in the late summer and autumn of 1936.

THOMPSON (W. L.). **Control of Purple Scale and Whiteflies with Lime-sulphur.**—*Rep. Florida agric. Exp. Sta. 1936–37* pp. 131–132. Gainesville, Fla. [1938.]

Further work on the effect of spray combinations containing copper compounds in the control of purple scale [*Lepidosaphes beckii*,

Newm.] on *Citrus* in Florida gave results largely similar to those obtained previously [*R.A.E.*, A **25** 88]. Scale increase was least after a single application of sprays containing proprietary copper compounds, greater when Bordeaux mixture was used at a concentration of 3–3–100, and greatest when it was used at 6–6–100 ; in each case, two applications resulted in a greater increase. One lime-sulphur spray could be omitted if 5–10 lb. wettable sulphur per 100 U.S. gals. was added to the copper spray. The minimum concentration of oil in the Bordeaux mixture that controlled Florida red scale [*Chrysomphalus ficus*, Ashm.] was 1 per cent.

JONES (E. T.). **Infestation of Grasses of the Genus *Aegilops* by the Hessian Fly.**—*J. econ. Ent.* **31** no. 3 pp. 333–337, 2 figs., 2 refs. Menasha, Wis., June 1938.

Grasses of the genus *Aegilops*, which are of recent introduction into the United States, have been observed to support appreciable infestations of *Mayetiola* (*Phytophaga*) *destructor*, Say, in Kansas. The species known to occur in the United States as weeds in fields and pastures are *A. cylindrica*, *A. ovata* and *A. triuncialis*. The first-named is a weed of wheat fields in Kansas, where it is a winter annual. The other two do not now occur generally in wheat fields in the state, but as they appear to be similar to *A. cylindrica* in habit, they will probably become established also.

Field observations and tests with artificially infested plants indicated that *A. cylindrica* from fields in central Kansas is extremely resistant to the development of larvae of *M. destructor*. In the few cases in which larvae developed, the puparia were indistinguishable from puparia produced on wheat. From observations in the field and in small test plots, *A. cylindrica* appeared to be considerably less attractive than wheat for oviposition, but the difference was less marked in greenhouse and hotbed tests. In a greenhouse test of the relative attractiveness of 15 strains representing 8 species of *Aegilops* and 2 wheat controls, *M. destructor* showed no outstanding tendency to oviposit on particular strains. All plants received eggs, but generally *A. ventricosa*, *A. triuncialis* and *A. cylindrica* received more than other species. There was a distinct preference for wheat. A greenhouse test for reaction to infestation was made on 22 strains representing 11 species. Observation indicated a uniformly normal hatch on all plants. Some strains of *A. cylindrica* and *A. ventricosa* appeared to be more resistant to the development of larvae than any of the other species in the test and are possible sources of resistant parent material for breeding resistant wheat ; strains of the same species differed widely in their reaction to infestation. Plants of some strains were able to recover from injury caused by infestation, in some cases by prolific tillering. In strains of *A. cylindrica*, *A. ventricosa* and *A. triuncialis*, some heavily infested stems were not injured by infestation, while stems of other strains were severely injured or killed. A number of plants of one of the strains of wheat used as controls recovered by tillering, but plants of the other were severely injured or killed. Uninfested stems of infested plants of the first strain were discoloured and otherwise affected, but uninfested stems of *Aegilops*, as a rule, gave no outward indication of infestation. Of nine wheat-*Aegilops* hybrids of F_4 and F_6 generations, only two were resistant.

PATCH (L. H.), BOTTGER (G. T.) & APP (B. A.). **Comparative Resistance to the European Corn Borer of two Hybrid Strains of Field Corn at Toledo, Ohio.**—*J. econ. Ent.* **31** no. 3 pp. 337–340, 2 refs. Menasha, Wis., June 1938.

In experiments in Ohio in 1936 and 1937, Michigan hybrid no. 561 [*R.A.E.*, A **24** 605], a strain of field maize reported to be resistant to attack by *Pyrausta nubilalis*, Hb., was found to be no more resistant in respect of the numbers of mature borers surviving from a given number of eggs than a standard susceptible strain, nor were less eggs deposited on it in nature. Moreover, the reduction in yield caused by a given number of borers was no less than the reduction expected on strains of equal yielding capacity.

NEISWANDER (C. R.). **The Annual White Grub, *Ochrosidia villosa* Burm., in Ohio Lawns.**—*J. econ. Ent.* **31** no. 3 pp. 340–344, 4 figs., 1 ref. Menasha, Wis., June 1938.

During 1937 and the two or three preceding years, white grubs, mostly larvae of *Ochrosidia villosa*, Burm., have severely injured lawns at many points in Ohio, principally in the east. In some lawns, larvae of the genus *Lachnosterna* (*Phyllophaga*) were also present. The population often reached 10–15 and sometimes 47 grubs per sq. ft., and the grass was practically destroyed. When infestation by *O. villosa* is heavy, the soil is pulverised and the turf feels soft and springy to the step. Eggs are laid during late June and July, mostly in grassland, and hatch after 19 days. The larvae are nearly full-grown when the cold weather approaches and migrate downwards in the month following mid-October to spend the winter at a depth of 14–16 ins. in the soil. They return towards the surface early in April and most of them are feeding on the roots of grasses by 1st May. In 1937, a downward migration was started by 4th June and the greatest mean depth for this period was reached by 15th June. This movement was followed by pupation, which took place at an average depth of 6·4 ins. The length of the pupal period averaged 18·7 days. Of 69 adults reared in 1937, 41 per cent. were females. The adults, particularly the males, are very much attracted to light. Of the total number collected, the males exceeded the females in the ratio of 7 to 1, but the sex ratio varied extremely for different nights in any one area. No food-plant of the adult has been found. Experiments, the results of which have already been noticed [*R.A.E.*, A **26** 398], were carried out on control with carbon bisulphide emulsion. During the autumn of 1937, experiments were made in which various treatments with lead arsenate were compared with the emulsion. None gave such a good kill, but this was probably because the grubs were not feeding all the time. Better control was obtained with 10 than with 5 lb. lead arsenate per 1,000 sq. ft. of soil surface, but it appeared to be immaterial whether the arsenate was mixed with the upper layer of soil before the grubs were introduced or scattered over the soil surface afterwards. A great advantage of lead arsenate is its known residual effect.

BAKER (W. A.) & BRADLEY (W. G.). **Field Status of European Corn Borer Parasites at the Close of 1936.**—*J. econ. Ent.* **31** no. 3 pp. 345–348. Menasha, Wis., June 1938.

The first releases of imported parasites of *Pyrausta nubilalis*, Hb., in the United States were made in Massachusetts in 1920, and

liberations in the states bordering on the great lakes were begun in 1924. Since the work started, a practically continuous series of releases has been made over the whole infested territory, and since 1928, parasites from eastern Asia have been used as well as European ones. Field observations have been made to determine progress. Of the 21 species of foreign parasites released since the beginning of colonisation in 1920, at the 14 selected test points in the lake and eastern states, 5 were recovered in 1936. *Lydella stabulans* var. *grisescens*, R.-D. [the Tachinid commonly called *Ceromasia senilis*, Mg.], which was released at 13 points, appeared at 11 and seems to be well established in most of them, parasitism being unusually high in individual fields. *Angitia* (*Inareolata*) *punctoria*, Rom., was released at 12 points and recovered from five, at one of which, where it was the predominating parasite, average parasitism was 12·35 per cent. *Chelonus annulipes*, Wesm., which had been released at five points was recovered from one, where it accounted for 4·37 per cent. of the total parasitism. *Macrocentrus gifuensis*, Ashm., was recovered from two points out of three, in which it was parasitising 0·97 and 2·05 per cent. of the borers taken. *Cremastus flavoorbitalis*, Cam., was represented by two individuals at one point not colonised during 1936. Importance is attached to this, as it was previously thought that the species could not overwinter in the northern states.

The most nearly complete information concerning the relationship of host and parasites was obtained in north-eastern Massachusetts. In this area, parasitism in the overwintering larvae increased gradually from 2·79 per cent. in 1927 to 15·16 per cent. in 1932, after which it fluctuated very little, and parasitism of the summer or first-generation larvae has averaged about 30 per cent. since 1928. Parasitism by native parasites has been generally low over the infested area during the entire period of observations. The most widespread species has been *Zenillia caesar*, Aldr.

Baker (W. A.) & Vance (A. M.). **Status of the European Corn Borer in 1937.**—*J. econ. Ent.* **31** no. 3 pp. 348–353, 2 figs. Menasha, Wis., June 1938.

The spread of *Pyrausta nubilalis*, Hb., in the eastern United States since 1932 has been slow. The present distribution is given, together with lists of localities from which initial infestations were recorded in 1934, 1935, 1936 and 1937. Information on the abundance of the larvae in maize during 1937 in different infested sections, obtained during a survey made from 16th May to 1st October involving 880 fields taken at random on a county or county group basis, in comparison with that for recent years, is tabulated, represented on a map and discussed in detail. In the surveyed areas of Michigan, Indiana and Ohio, *P. nubilalis* was as generally distributed and as abundant in 1937 as in any previous year of record. In New York, its abundance decreased in comparison with 1936 in one county group, while in another district, it was present in about the same numbers as during the previous survey, which was made in 1935. Along the Atlantic coast, it increased in abundance in 1937, compared with 1936, in central Connecticut, south-eastern New Jersey and southern Delaware, on the eastern shore of Maryland and Virginia and in part of eastern Massachusetts. In western Massachusetts, however, there was a significant decrease in population.

A survey of infestation of potatoes by the first generation was carried out during the last two weeks of July 1937 on eastern Long Island, in central Connecticut and in west-central Massachusetts, and the average populations per 100 plants were found to be 60, 106·2 and 73·5. On eastern Long Island, the only one of these areas in which potatoes had been surveyed previously, the populations from 1932 to 1935 were 22·8, 64·0, 48·7 and 30·1. Both on Long Island and in Connecticut, 88 per cent. of the fields showed infestation, compared with 56 per cent. in Massachusetts. The maximum number of borers found in a single potato plant in 1937 was 12.

ISELY (D.). **Codling Moth Oviposition and Temperature.**—*J. econ. Ent.* **31** no. 3 pp. 356–359. Menasha, Wis., June 1938.

The work on the effect of temperature on the oviposition of *Cydia* (*Carpocapsa*) *pomonella*, L., reported in this paper, was carried out in north-western Arkansas during 1936 and 1937. The females were placed individually in battery jar cages on the day of emergence, usually with two males, and fed on diluted honey through a sponge. After oviposition began, they were transferred to new cages each morning and the eggs counted. About two-thirds of the females oviposited when the temperature was favourable. The others were not included in the averages. Individual variation was great. The mean daily temperature at which the largest number of eggs was laid per day was 27°C. (80·6°F.). At this temperature, an average of 19·22 eggs per day was deposited. Frequently over 100 eggs were laid in one day by individual moths. A rise of temperature above optimum tends to reduce the average number of eggs deposited daily, but it occasionally increases the rate of oviposition while shortening the life of the female, and it sometimes abruptly terminates oviposition. Great heat for only a few days prevented newly-emerged moths from ever depositing eggs, and eggs laid by moths that had been exposed to excessive temperatures as larvae or pupae tended to be sterile. The daily mean temperature in north-western Arkansas seldom rises above the optimum for long enough to have a noticeable effect on subsequent infestation of apples, but it did so in 1934 and 1936. Temperature below optimum reduced daily oviposition, but lengthened the reproductive period; it also made oviposition irregular. During the cool weather which prevailed during much of the life of adults of the overwintered brood, egg-laying was intermittent and often interrupted for several days. Near the end of the season, when there was intermittent cold weather during which little oviposition occurred, the number of eggs deposited on warm days was proportionately higher than when the temperature was continuously high enough for regular egg-laying. At the same temperature, moths of the summer broods laid more eggs than those of the overwintered brood, and moths of the summer brood maturing early in July laid more than those maturing later.

The temperature at which the highest numbers of eggs were laid per day was not that at which the highest total numbers were laid. In the two years, the highest total number (an average of 146) was deposited when the mean temperature for the entire oviposition period was 25°C. [77°F.]. The highest number of eggs deposited by a single moth was 345. The oviposition period was longest when the mean temperature was 23°C. [73·4°F.]. It shortened rapidly above 28°C. [82·4°F.], and averaged less than 2 days above 32°C. [89·6°F.].

The oviposition period of moths of the summer broods in 1937 averaged about a week, but was occasionally much longer, the maximum being 20 days. Over 90 per cent. of the eggs were deposited during the first week of oviposition. The oviposition period of females of the overwintered brood, which were flying when the temperature was much lower, was proportionately longer, 12 days being required for 90 per cent. of the eggs to be laid. In 1937, the preoviposition period averaged 5·47 days for 51 moths of the overwintered brood and 3·18 days for 192 of the summer broods.

MARSHALL (G. E.) & HIENTON (T. E.). **The Kind of Radiation most attractive to the Codling Moth. A Progress Report.**—*J. econ. Ent.* **31** no. 3 pp. 360–366, 2 figs., 4 refs. Menasha, Wis., June 1938.

Orchard and laboratory studies on the kind of radiation most attractive in light-traps for the codling moth [*Cydia pomonella*, L.] were carried out in Indiana in 1937. Details are given of the technique for the laboratory studies, which were the more extensive. In the orchard, it was shown that efficiency was increased by increasing the light intensity. Intrinsic brilliance and colour from blue and violet to shorter wave lengths were very attractive. It was concluded from the laboratory tests that intrinsic brilliance, the size of the luminous area and the colour influence the attractiveness of light to the moth. Small amounts of ultra-violet, in addition to blue and violet, seem to have little attraction. Large amounts of ultra-violet, based comparatively on the lamps used in the tests, add to the attractiveness of the lamp. It would seem that the best lamp to attract the codling moth would be one with the right shade of blue, with great intrinsic brilliance and with a large luminous area. The dark blue 200-watt tungsten filament lamp, when all other conditions were equal, showed the greatest attractiveness of all lamps tested.

STEINER (L. F.) & SAZAMA (R. F.). **Experiments with Tank-mix Nicotine-Bentonite-Soybean Oil for Codling Moth Control.**—*J. econ. Ent.* **31** no. 3 pp. 366–374, 1 fig., 3 refs. Menasha, Wis., June 1938.

Field and laboratory-field tests on the merits of a combination of nicotine bentonite and soybean oil as a substitute for lead arsenate for the control of the codling moth [*Cydia pomonella*, L.] on apple were carried out in southern Indiana in 1935–37. In the laboratory-field tests, which were conducted by the method of F. H. Lathrop & R. F. Sazama [*R.A.E.*, A **20** 290] somewhat modified and improved, a tank mixture of 1 U.S. pint nicotine sulphate, 5 lb. bentonite, 1 U.S. quart soybean oil, and $\frac{1}{4}$–$\frac{1}{2}$ oz. sodium lauryl sulphate per 100 U.S. gals., the most effective substitute tested, was equal or superior in larvicidal efficiency to the heaviest applications of lead arsenate that can be recommended for use in the area. No foliage injury was observed, and the residue, though conspicuous, could be removed by washing in a brush machine with weak alkali or sometimes dry brushing.

In field tests in 1937, in which 6 nicotine bentonite and 7 lead arsenate sprays were compared, both gave nearly perfect control, but heavy infection of bitter rot developed in the area that received nicotine bentonite, as this is incompatible with the usual fungicides and none had been used after the first application. Wettable sulphur

was included in the first nicotine spray and the soybean oil omitted in this but included in the others. This and other experiments showed that oil can follow sulphur at a much shorter interval when combined with nicotine bentonite than when used with lead arsenate.

In 1937, nicotine bentonite was shown to be superior to lead arsenate in experiments on a commercial scale, an account of which has already been noticed [**26** 652]. The formula for the spray of tank-mix nicotine bentonite and soybean oil is here given as 1 U.S. pint nicotine sulphate, 5 lb. bentonite, 1 U.S. quart soybean oil and $\frac{1}{4}$ oz. sodium lauryl sulphate. A high proportion of new entries in September in the fruit sprayed with nicotine indicated that the interval between the last nicotine spray and harvest was too long. A nicotine spray in early September was needed.

HUTSON (R.), MERRITT (J. M.) & PARMELEE (F.). **Comparative Tests of Fixed Nicotines and Lead Arsenate against Codling Moth.**— *J. econ. Ent.* **31** no. 3 pp. 374–378, 3 refs. Menasha, Wis., June 1938.

During 1936 and 1937, fixed nicotines and combinations of fixed nicotines with other materials were tested against *Cydia* (*Carpocapsa*) *pomonella*, L., on 280 apple trees in an orchard in Michigan, under conditions of moderate to heavy infestation. Fungous diseases were controlled by applications of sulphur in the pre-blossom sprays. Spraying was conducted on a 10-day schedule except in the case of lead arsenate in 1936. In 1936, all plots received a calyx spray and a first cover spray of 3 lb. lead arsenate [per 100 U.S. gals.], followed by either 7 applications of 3 lb. lead arsenate with 4 lb. lime, or 10 applications of 5 lb. Black Leaf 155X, 8 lb. Black Leaf 155Z, 3 lb. Black Leaf 155O, 5 lb. Ortho Nicotine with $\frac{1}{2}$ U.S. gal. Orthol K or 2 lb. Black Leaf 155X with $\frac{1}{2}$ U.S. gal. Orthol K, or 8 applications of a spray composed of 5 lb. bentonite, soap, and $\frac{3}{4}$ U.S. pint nicotine sulphate followed by 2 applications of $\frac{3}{4}$ U.S. gal. Orthol K with $\frac{3}{4}$ U.S. pint nicotine sulphate. Black Leaf 155X, 155Z and 155O are preparations of nicotine sulphate and bentonite containing 8, 5 and 13 per cent. nicotine, respectively. All the fixed nicotine sprays gave better control of entries and stings combined than the lead arsenate; the addition of oil greatly decreased the total injury by the larvae, but caused foliage drop and various injuries to the fruit. When bentonite (tank mixed) was used, the residue could only be removed by scrubbing, and colour did not develop well under the coating. Black Leaf 155X at 5 lb. used alone did not compare very favourably with other fixed nicotines, but 2 lb. Black Leaf 155X and $\frac{1}{2}$ U.S. gal. Orthol K formed one of the best mixtures. Control varied considerably on different varieties.

In 1937, no lime was used in lead arsenate sprays; the calyx and first cover of lead arsenate were followed by 8 applications of 8 lb. Black Leaf 155 (8 per cent. nicotine), 4 lb. Black Leaf 155 with $\frac{1}{2}$ U.S. gal. Orthol K, 3 lb. Black Leaf 155 with $\frac{1}{2}$ U.S. gal. Orthol K, $1\frac{1}{2}$ U.S. pints nicotine oleate with 5 lb. bentonite (fixator A), or lead arsenate. Again, all the nicotine sprays gave better control than lead arsenate, the best being those containing oil. The only noticeable injury was on the plot sprayed with 3 lb. Black Leaf 155 and oil. Nicotine oleate left a heavy persistent residue, but other nicotine combinations an inconsiderable residue.

CHANDLER (S. C.). **Recommendations for Control of Plum Curculio on Peach.**—*J. econ. Ent.* **31** no. 3 pp. 378–379, 1 fig. Menasha, Wis., June 1938.

A comparative study is made of the strength, number and timing of sprays of lead arsenate recommended to be applied to peach trees in the eastern United States and Ontario for the control of the plum curculio, *Conotrachelus nenuphar*, Hbst. In view of wide divergence in practice and inexplicable difference in the behaviour of the weevil in different and often adjacent states, the author concludes that it is necessary for states to investigate their requirements individually and disregard recommendations made in neighbouring states.

FLINT (W. P.), FARRAR (M. D.) & CHANDLER (S. C.). **Experiments in the Control of Oriental Fruit Moth with Oil Dusts.**—*J. econ. Ent.* **31** no. 3 pp. 380–382. Menasha, Wis., June 1938.

Dusts containing oils were first used for the control of *Cydia* (*Grapholitha*) *molesta*, Busck, on peach in southern Illinois in 1929 [*R.A.E.*, A **18** 475], and in view of the promising results obtained, tests were carried out in every subsequent year in which the peach crop was sufficiently good.

No tests were made on late varieties. The dusts have been improved from year to year. The one at present recommended for use early in the season, which should not be applied within 30 days of picking, consists of 30 lb. sulphur (300 mesh, dusting grade), 25 lb. hydrated lime, 30 lb. talc (300 mesh), 10 lb. lead arsenate and 5 lb. oil (Saybolt 104, unsaturated) ; and the one recommended for use late in the season consists of 60 lb. sulphur, 15 lb. hydrated lime, 20 lb. talc and 5 lb. oil. In 1930, 1933 and 1934, no experiments were carried out, and in 1931, infestation was so slight that no results were obtained. In 1929, dust impregnated with oil gave 80 per cent. control and standard dust 20 per cent. In 1932, there was little difference between control effected by dusts and sprays. In 1935, the weather was very favourable to the development of *C. molesta* and the three pre-harvest dusts applied were not sufficient to give very good control. Good control of a moderate infestation was obtained in four series of tests with oil-containing dusts in 1936. In the same year, in large commercial orchards, such dusts gave 75–97 per cent. control and in another orchard 4 applications gave 80 per cent. control, whereas 2 sprays applied during the month before harvest gave 60 per cent. In 1937, when infestation was again moderate, 4 applications of dusts with oil, starting 3 weeks before harvest, gave 69 per cent. control, and four sprays of fixed nicotine starting at the same time gave 25 per cent. In tests in a mixed orchard containing apples and peaches, 5 applications of a home-made oil-containing dust (not of the suggested formula) showed 70 per cent. efficiency in a comparison in which the efficiency of a fixed nicotine spray was rated as 0. In many cases, results obtained in practice were better than those obtained experimentally.

The tests did not show any increased control of *C. molesta* through the application of oil-containing dusts early in the season [*cf.* **26** 544], and these applications should be made only when needed for the control of the plum curculio [*Conotrachelus nenuphar*, Hbst.]. Against *C. molesta*, 4 applications should be made, the first about 3 weeks before harvest and the last 2 or 3 days before.

Neiswander (R. B.). **The Strawberry Leaf Roller, *Ancylis comptana* (Froel.), in Ohio.**—*J. econ. Ent.* **31** no. 3 pp. 382–385. Menasha, Wis., June 1938.

Ancylis comptana, Froel., has been widely distributed in Ohio for many years, but its economic importance was not considered great until 1935. An outbreak occurred in the south-west in 1934, and the population increased during the two following seasons. Crops were severely reduced on untreated plantings in 1936, and up to 76 per cent. of the leaflets were damaged in the infested area in the western part of the state. During 1937, damage was less severe there, but heavy in north-central Ohio.

Observations on the life-history were made on 4,976 eggs, 1,339 larvae, 141 pupae and 1,444 adults, during 1936 and 1937. There were two complete generations and a partial third during each season. All the larvae of the third brood and some of the second hibernated. Adults of the overwintered brood emerged during May, those of the first brood during July and early August, and those of the second brood during the latter part of August and the first few days of September. Females of the overwintered, first and second broods laid, on an average, 80, 53·3 and 42·6 eggs, respectively. The maximum number laid by one female was 158. The incubation period lasted on an average 10·8, 8·6 and 7·8 days in the first, second and third broods, respectively. The lengths of the combined larval and pupal periods of the first and second generations averaged 40 and 35·3 days, the average lengths of the pupal periods being 9·5 and 9·3 days.

Macrocentrus ancylivorus, Rohw., a larval parasite of *A. comptana* and the oriental fruit moth [*Cydia molesta*, Busck] was not known to be present in south-western Ohio before 1935, when a colony was released in a strawberry planting adjoining a peach orchard. It multiplied rapidly and effectively parasitised *C. molesta* in 1936 and 1937. In September 1936, 97 per cent. of a collection of larvae of *C. molesta* taken from peach twigs were parasitised by it, and it accounted for 95 per cent. of the total parasitism of this species in one county in 1937. During the latter year, however, only 6·4 per cent. of the larvae of *A. comptana* collected in Ohio were parasitised, and *M. ancylivorus* accounted for only 21·2 per cent. of the parasitism. *Cremastus cooki*, Weed, was the most effective parasite.

As lead arsenate did not give successful control in 1934 and 1935, 16 treatments were tested in 1936 against the first brood. Applications were made on 11th or 12th, 21st or 22nd and 27th May. Only materials that would not leave a poisonous residue were used in the third application. Many treatments were much superior to lead arsenate. In the following results, the effective ingredient of each substance is given in brackets. Two applications of a spray of 5 lb. Kalo (natural cryolite) with 100 cc. Grasselli Spreader-Sticker (sulphated alcohol) in 100 U.S. gals. water, and 3 of 12·5 lb. derris (4 per cent. rotenone) with 87·5 lb. gypsum both gave over 75 per cent. control and were significantly better than any other treatment used (including a cubé dust with the same rotenone content as the derris dust). In 1937, larvae appeared suddenly nearly two weeks later in the season than in 1936, and several materials were tested in a single application on 3rd or 4th June when the berries were ripening. Sprays of Red Arrow (pyrethrum) and Kalo and a dust of Dry Pyrocide (pyrethrum) all proved more efficient than powdered derris root or a

dust containing 0·75 per cent. rotenone with which the rest of the plot was treated, and each gave more than 50 per cent. control, but the differences among them were not significant. In the same year, 10 treatments, 7 of which had fluorine as the toxic agent, were tested in three applications against the second brood from 15th July when the first eggs were hatching. At the time of the third application, the materials containing fluorine had given a control of 80–87 per cent. and there were no significant differences between them, but all appeared more effective than the three remaining materials. Eighteen days later, 5 lb. Kalo or 5 lb. Alorco (synthetic cryolite) with 2 oz. Grasselli Spreader-Sticker and 100 U.S. gals. water, dusts of 1 part Alorco, Kalo, Dutox (barium fluosilicate and sodium fluoaluminate) and Kryocide (natural cryolite) with 2 parts talc and 2 parts flour and a dust of 3 parts Kalo with 6 parts talc had effected 89·3, 92·6, 91·2, 94·6, 95·2, 95·6 and 92·4 per cent. control, respectively, whereas 2 pints Red Arrow and 4 pints Orthol K in 100 gals. water, 3 lb. phenothiazine [thiodiphenylamine] in 100 U.S. gals. water and Dry Pyrocide and talc (1 : 9) gave only 74·3, 55·4 and 76·9 per cent. control.

RITCHER (P. O.). **Biology and Control of the Strawberry Crown Borer, *Tyloderma fragariae* (Riley), in Kentucky.**—*J. econ. Ent.* **31** no. 3 pp. 385–388, 1 fig., 1 ref. Menasha, Wis., June 1938.

For 40 years, *Tyloderma fragariae*, Riley, has been the most serious pest of strawberries in Kentucky, particularly in the west. A study, of which this is a progress report, was begun in the autumn of 1936. Most of the weevils passed the winter of 1936–37 as adults under débris in infested patches, but a few remained as larvae in infested plants and matured in February and March. There were 2 generations during 1937. In February and March the adults became active and fed on days when the temperature was 55°F. or above. Oviposition began early in March and continued until the end of August, but was very slight until the beginning of April. The first larvae hatched in April, and some of the first generation could still be found in September. Pupation began in mid-June, and first-generation adults emerged from the first week in June to the end of October, the majority in July and August. Second-generation eggs were laid from late July to September, and most of the resulting larvae gave rise to adults before the end of the year. These and first-generation adults fed on strawberry foliage in the autumn. Eleven pairs of overwintered adults were kept in the insectary, and the females laid 29–102 eggs during the season. The incubation period was long in the spring, and averaged about 10 days in June–August; the larval period, which comprises 5 instars, lasted about 20 days in midsummer, and the pupal period 8–11 days during June–August.

Eggs were always laid in or on the strawberry plant, usually in shallow excavations in the wide leaf bases covered with dirt and bits of the plant tissue, but some eggs were merely tucked behind dead tissue, and others deposited in the crown itself or in the lateral roots. The chief injury is caused by the tunnelling of the larvae in the crowns. In experimental plots, 55 per cent. of the infested plants of one variety were dead or badly stunted by early August; the remainder showed little effect themselves, but sent out fewer runners than healthy plants.

T. fragariae was found breeding in wild strawberry (*Fragaria virginiana*) and common cinquefoil (*Potentilla canadensis*), which is

abundant in western Kentucky. *Microbracon analcidis*, Ashm., was parasitising about 2 per cent. of the larvae examined during 1937; one larva of *Hister americanus*, Payk., was found consuming a large larva of *T. fragariae*, and a number of Elaterid larvae were found feeding on larvae or pupae. Two of these were reared and identified as *Conoderus* (*Monocrepidius*) *auritus*, Hbst.

Adults of *T. fragariae* cannot fly, but can crawl considerable distances; 7 out of 160 released 125 yards from a strawberry patch, and 1 out of 612 released 300 yards away, were recovered. One covered 125 yards in less than 3 days. Adults lived 16–19 days when deprived of food but given moisture. Whenever possible, new strawberry patches should be set on land that has been cultivated for one or more years, and 350 yards from a source of infestation. Where it is impossible to plant at this distance, a barrier should be used. A suitable one consists of a strip of rough boards, 1 × 6 ins., set on edge round the patch and driven into the soil to a depth of 2 or 3 ins. An L-shaped strip of galvanised iron, turned outward, is fixed to the top of each board. Old patches should be ploughed immediately after picking, disked and dragged, and sown with another crop. Plants from heavily infested patches can be freed from borers by digging and cleaning them in the spring before oviposition begins, but it is best under farm conditions to use only certified plants from inspected patches. Wild food-plants on farms should be destroyed.

LILLY (J. H.). **A Method for measuring Effects of Dormant Sprays upon Apple Tree Growth.**—*J. econ. Ent.* **31** no. 3 pp. 388–393, 2 figs., 13 refs. Menasha, Wis., June 1938.

A method of measuring the effect of dormant oil sprays on apple trees, which has been used successfully in Wisconsin for five years, is described. One-year-old wood, 4–11 ins. long and selected at random from all sides of the trees, is used as count-wood. The length of each count unit is measured, and the number of buds on it that have put out two or more leaves is recorded. Similar counts are made on unsprayed trees of comparable vigour. The average number of buds on units of each length is then calculated and the results shown graphically. The significance of the difference between figures for sprayed trees and controls is tested mathematically. The results obtained were consistent over the five years. It was shown that under the conditions existing in the early part of 1936, when the buds had been injured by a very severe winter, some dormant oil treatments actually stimulated the development of the buds. The method is as well adapted for recording beneficial effects as injuries. A few combinations, mainly the less refined oils used in cold-mix emulsions in concentrations of 6 per cent. or more and similar oils in lower concentrations but with certain toxic agents, were definitely injurious. Most treatments did not cause growth to differ significantly from that on controls when used according to recommendations.

GINSBURG (J. M.) & DRIGGERS (B. F.). **Coal Tar Distillates in Dormant and Delayed Dormant Sprays on Apple Trees.**—*J. econ. Ent.* **31** no. 3 pp. 393–400, 16 refs. Menasha, Wis., June 1938.

In 1926, tests were begun in New Jersey to find inexpensive chemicals that would control Aphids on apple and could be used in

place of nicotine sulphate (1 : 500) at the delayed dormant stage, in combination with the petroleum oil spray applied against scale insects and the European red mite [*Paratetranychus pilosus*, C. & F.]. The chief Aphids concerned are *Rhopalosiphum prunifoliae*, Fitch, *Aphis pomi*, DeG., and *Anuraphis* (*Aphis*) *roseus*, Baker, all of which overwinter in the egg stage. Experiments during the period 1926–28 showed that certain coal-tar derivatives, primarily of the acid group, were toxic to Aphid eggs, especially if applied just before hatching, and a delayed dormant spray of 3 per cent. petroleum oil and 0·5 per cent. crude cresylic acid was recommended and subsequently widely used to control Aphids, scales and the red mite.

As the shortness of the delayed dormant period sometimes makes it difficult in bad weather to complete the application before there is danger of injury, a series of laboratory and field experiments was begun in 1933 to perfect a dormant spray suitable for replacing the delayed dormant one. Previous studies by various workers on coal-tar derivatives are reviewed from the literature, and it is concluded that 1·8–2·4 per cent. tar oil will kill eggs of apple Aphids, whereas 4–5 per cent. is necessary to control San José, scurfy and oystershell scales [*Aspidiotus perniciosus*, Comst., *Chionaspis furfura*, Fitch, and *Lepidosaphes ulmi*, L.]. However, as the scales and the red mite are readily controlled with petroleum oil, which costs approximately half as much as the tar oil, a combined dormant spray of about 2·5 per cent. tar oil and 3 per cent. petroleum oil is efficient in controlling them all. It did not injure the trees. The maximum concentration of tar distillate or a combination of tar distillate and petroleum oils that the dormant tree can withstand is about 6 per cent. In 1934, a spray containing about 5 per cent. actual tar oil and one containing 3 per cent. petroleum oil and about 2 per cent. tar oil both gave complete control of Aphids, and neither injured the foliage, but the bark on the sprayed trees had a yellow to brown appearance, more pronounced on the block treated with tar oil alone. Two experiments in 1935, in which three dormant sprays containing cresylic acid and one containing tar oil were compared with the delayed dormant spray, indicated that a mixture containing 3 per cent. petroleum oil and 2·4 per cent. tar oil and one containing 4 per cent. petroleum oil and 0·5–1 per cent. cresylic acid gave control of *R. prunifoliae* and *A. pomi* comparable to that given by the delayed dormant spray. *A. roseus*, the species of greatest importance, was not present. In 1936, when all three species of Aphid were present, the tests were repeated. By April, the spray containing tar oil gave slightly better control than the delayed dormant one, while the other dormant sprays were less effective. Counts later in the season showed complete absence of *A. roseus* on the trees that had received the two best sprays. All treatments gave good control of the red mite. No dormant spray caused any injury to the trees or retarded bud development, but the delayed dormant sprays caused appreciable injury to fruit buds and early foliage on two varieties out of three. In 1937, commercial and home-made emulsions of tar oil with petroleum oil were compared. The home-made stock emulsion consisted of 37, 30 and 33 parts by volume of petroleum oil, tar oil and water, respectively, and 1 part by weight of Goulac (sulphite lye) emulsifier. There was no appreciable difference between the two emulsions. The cost of the petroleum and tar oil spray is considerably higher than that of the delayed dormant spray of oil and cresylic acid.

JONES (H. A.) & SULLIVAN (W. N.). **Evaluating Derris and Cubé : The Question of Total Extractive Content.**—*J. econ. Ent.* **31** no. 3 pp. 400–405, 6 refs. Menasha, Wis., June 1938.

The following is the authors' summary : Of several solvents tested for the determination of total extractive content of derris and cubé roots from the standpoint of selective extraction of the toxic material, chloroform was the most satisfactory. Soxhlet extractions for seven hours with this solvent gave satisfactorily complete extraction of the toxic material. Results of the room-temperature, aliquot procedure [described in a paper already noticed (*R.A.E.*, A **26** 331)] were in fair agreement with these, although on the average slightly lower. Because of the convenience of the determination, particularly when rotenone is being determined on the sample by the same method, the latter procedure is suggested as suitable for determination of total extractive content.

FULTON (R. A.) & HOWARD (N. F.). **Effect of Addition of Oil on the Toxicity to Plant Bugs of Derris and other Insecticides.**—*J. econ. Ent.* **31** no. 3 pp. 405–410, 3 figs., 5 refs. Menasha, Wis., June 1938.

An account is given of laboratory tests to determine whether the toxicity of derris, free nicotine, nicotine sulphate and anabasine sulphate to plant bugs such as *Anasa tristis*, DeG., could be increased by the use of oil emulsion. Various vegetable oils and oil of petrolatum were used ; the emulsifying agent was sodium lauryl sulphate except in tests involving acetone, when triethanolamine oleate was substituted. The derris powder contained 4·5 per cent. rotenone and 14·5 per cent. carbon tetrachloride extractives. In cage tests on *A. tristis*, 1 per cent. oil emulsions were used. The toxicity of the insecticides was markedly increased by the use of oil, especially groundnut oil. The toxicity of derris was greatly increased by the addition of acetone 24 hours before use and further increased by the use of groundnut oil. Freshly prepared derris extract was very effective. Vegetable oils increased toxicity much more than the oil of petrolatum. Tests were also carried out with derris against individuals of *Oncopeltus fasciatus*, Dall., fastened on to sheets of cork, the insecticide being applied to the dorsal side of the abdomen. All oils increased the toxicity of the derris, but mineral oil appeared to be practically as effective as the groundnut oil. In tests in the field, two applications of sprays containing derris (0·015 per cent. rotenone) and 1 per cent. of olive, groundnut or teaseed oil or oil of petrolatum did not injure the foliage of squash plants.

GOODHUE (L. D.). **The Particle Size of commercial Insecticidal Sulfurs as determined by Sedimentation Analysis.**—*J. econ. Ent.* **31** no. 3 pp. 410–414, 1 fig., 13 refs. Menasha, Wis., June 1938.

The following is taken from the author's summary : The particle size distribution in 44 samples of commercial insecticidal sulphur was determined by sedimentation analysis. A new method of dispersion in which is used a wetting agent composed of a mixture of saponin and ammonium caseinate in ammoniacal 50 per cent. alcohol was found to give very good results on a wide variety of samples. The percentage passing through a 325-mesh sieve was found to give very little indication of the amount of very fine sulphur in a sample.

Bronson (T. E.) & Dudley, jr. (J. E.). **Conditioning Agents for increasing the Effectiveness of Rotenone-bearing Dusts against the Pea Aphid.**—*J. econ. Ent.* **31** no. 3 pp. 415–419, 2 refs. Menasha, Wis., June 1938.

The first tests of derris dusts against *Macrosiphum onobrychis*, Boy. (*Illinoia pisi*, Kalt.) on peas for canning made in Wisconsin in 1935 were not completely satisfactory [*cf. R.A.E.*, A **24** 601]. Further tests against this Aphid have since been made with derris in the greenhouse and both derris and cubé in the field to ascertain whether the addition of small quantities of various spreading and wetting agents would improve the distribution, hygroscopic qualities and effectiveness of the dusts. Talc was the diluent used, and the conditioners, sometimes slightly diluted with water, were atomised into the ingredients while they were being mixed. The dust so prepared was slightly damp, but did not need to be dried before use.

In greenhouse experiments, all mixtures had a low rotenone content (0·4 per cent.) in order that the differences between plain and conditioned dusts might be apparent. In 1936 and 1937, consistently higher percentages of Aphids were killed in a shorter time with conditioners than before these were used. A dust conditioned with 1 per cent. of a sodium oleyl sulphate gave average mortalities of 69 and 88·5 per cent. after 2 and 5 days. Plain derris dust gave mortalities of only 40·5 and 54 per cent. Various spreading and wetting agents were tried as conditioners; the majority had value, but none was superior to sodium oleyl sulphate. The addition of 1½ per cent. of 50 per cent. free nicotine and 2 per cent. of a pyrethrum extract (4·3 per cent. pyrethrins) to the conditioned dust gave satisfactory results, the first mixture effecting an average mortality of 91·5 per cent. after both 2 and 5 days and the second 85 and 88 per cent. mortalities after 2 and 5 days, respectively, but the best results were obtained by the addition of 1·5 per cent. of a proprietary aliphatic thiocyanate which resulted in consistently higher mortality at lower temperatures than were obtained with the other mixtures, average mortalities after 2 and 5 days being 94 and 99 per cent., respectively. The aliphatic thiocyanate and sodium oleyl sulphate with talc and no derris caused 25 per cent. mortality after 5 days; on all other controls, the number of Aphids increased. Nearly all dusts gave higher mortality at increased temperature or relative humidity or both. In a further greenhouse experiment, three derris dust mixtures conditioned with sodium oleyl sulphate and each containing one of the three solvents commonly used for extracting rotenone, namely, acetone, alcohol and carbon tetrachloride, gave practically 100 per cent. mortality when the temperature was relatively high, and were superior to dusts with sodium oleyl sulphate only, but not to those with the aliphatic thiocyanate as well.

Field experiments failed to reveal any difference in effectiveness between derris and cubé. Dusts with rotenone contents of 0·5, 0·75 or 1·0 per cent. were used. Differences between groups of dusts were not as great or as consistent in the field as in the greenhouse, probably on account of variable conditions. Mortality from conditioned dusts was usually 90 per cent. or over in about 2 days, and reduction in infestation 95–98 per cent. after 5–10 days. Frequently the toxic effect persisted for 2 weeks or more, lessening the rate of reproduction of the surviving Aphids. Average reduction in infestation was 90

per cent. when nicotine was added and always above 90 per cent. when an aliphatic thiocyanate was added. In 11 tests with such a mixture containing 0·75 per cent. rotenone, it averaged 95·5 per cent. In 12 tests, conditioned and plain dust mixtures gave average reductions of 91 and 79 per cent., respectively.

MOORE (Wm) & CARPENTER (E. L.). **The Fumigation of Insects with Hydrocyanic Acid: Effect of different Air Pressure.**—*J. econ. Ent.* **31** no. 3 pp. 419–426, 3 figs., 4 refs. Menasha, Wis., June 1938.

The following is based on the authors' summary: An apparatus has been devised that may be used for the determination of either the amount of different vapours taken up by insects [*R.A.E.*, A **26** 567] or the toxicity of the vapours to them, at pressures varying from total vacuum to atmospheric pressure. The method of using it for the latter purpose is described. A study was made of the susceptibility of several different species of insects to hydrocyanic acid gas at different pressures. No flour or other solid material was used in the chamber. The effect of reducing pressure in a fumigation chamber is first to increase the activity of the insect and then slowly decrease it until it disappears altogether. The best kills of *Tribolium confusum*, Duv., were obtained with inactive insects at 1–2 mm. air pressure [*cf.* **24** 178], whereas the best kills of *Calandra* (*Sitophilus*) *oryzae*, L., *C.* (*S.*) *granaria*, L., *Laemophloeus minutus*, Ol., *Lasioderma serricorne*, F., and *Oryzaephilus surinamensis*, L., were obtained at 30–60 mm. when the insects were active. There was no difference in the kills of *Rhizopertha dominica*, F., obtained at pressures between 2 and 60 mm. The percentage kills decreased in all cases as the air pressure was increased from about 60 mm. to atmospheric pressure. The reduction in kill effected by the presence of air in the fumigation chamber was shown to be due to nitrogen as well as oxygen. The effect of nitrogen is probably physical, whereas that of oxygen is probably both physiological and physical. It was shown that active individuals of *C. oryzae* take up much larger quantities of HCN than inactive ones, whereas no difference was found between active and inactive individuals of *T. confusum*. It appears that some insects, such as *C. oryzae*, can prevent the penetration of HCN to some extent when they become inactive, whereas others such as *T. confusum* cannot.

SWINGLE (H. S.). **Relative Toxicities to Insects of Acid Lead Arsenate, Calcium Arsenate and Magnesium Arsenate.**—*J. econ. Ent.* **31** no. 3 pp. 430–441, 1 fig., 28 refs. Menasha, Wis., June 1938.

As insoluble arsenicals are as toxic or almost as toxic to many insects as are the more soluble arsenicals, the use of which in sprays has been abandoned owing to their injurious effect on plants, and as only soluble materials can pass through the cell-walls lining the digestive tract, the slightly soluble arsenicals must become more soluble within the alimentary tract of an insect before poisoning can occur. Absorption of water-soluble materials takes place principally in the mid-gut. In investigations in Alabama, a short account of which has already been noticed [*R.A.E.*, A **26** 690], a study of the digestive secretions of 9 species of phytophagous insects showed them to vary in acidity from pH 5·9 to 9·6, and analysis of the secretions of 8 of the species

showed that phosphate was the only anion found in the mid-gut of all. In order that the action of the arsenical insecticides might be more fully understood, the factors affecting the rate of solution of the arsenic were studied.

The following is from the author's summary: The formation of soluble arsenic from acid lead arsenate, calcium arsenate and magnesium arsenate was largely dependent on the hydrogen-ion concentration of the solutions used. It was influenced to a lesser extent by the concentration of acids, bases and salts in the solution. The presence of phosphates greatly increased the amount of soluble arsenic formed from acid lead arsenate in alkaline solutions. This was apparently due to the precipitation of part of the lead as lead phosphate, as this compound was very insoluble in alkaline solutions. Phosphates influenced the solubility of the arsenic in calcium and magnesium arsenates to only a slight extent. The relative toxicity of acid lead arsenate, calcium arsenate and magnesium arsenate to the 9 species of insects was shown to be correlated with the relative amounts of soluble arsenic formed from these arsenates in phosphate solutions having the same pH as was found in the mid-guts of the insects. For insects having an alkaline reaction in their mid-gut, acid lead arsenate was most toxic and magnesium arsenate least toxic; for insects having an acid reaction of pH 6·0 in their mid-gut, magnesium arsenate was most toxic and acid lead arsenate least so. It appears possible to predict the relative order of toxicity of acid lead arsenate, calcium arsenate and magnesium arsenate to chewing insects, if the hydrogen-ion concentrations in the insects' mid-guts are known.

Hodgkiss (W. S.), Frear (D. E. H.) & Worthley (H. N.). **A chemical Study of Mixtures of Lime Sulfur and Lead Arsenate.**—*J. econ. Ent.* **31** no. 3 pp. 443–454, 4 figs., 18 refs. Menasha, Wis., June 1938.

When mixed in a spray, lead arsenate and lime-sulphur tend to reduce the effectiveness of each other and promote injury to plant surfaces, particularly by reducing the polysulphide sulphur and increasing the soluble arsenic. In view of this, a study was made of the chemical changes that occur in such spray solutions before application. The lime-sulphur concentrate used had a Baumé reading of 31·62° and a sulphur content of 24·05 per cent. The acid lead arsenate was chemically pure and was used at the rate of 3 lb. per 100 U.S. gals.

The following is based on the authors' conclusions: Oxidation in lime-sulphur solutions more concentrated than 1 : 100 was negligible during the first hour. The solutions contained quantities of soluble sulphur, the amount of which depended upon the degree of dilution. Under the conditions of the experiment, the sulphide sulphur of a lime-sulphur solution at 1 : 50 almost entirely disappeared in 45 hours. The loss of sulphide sulphur was proportionate to the increase in the concentrations of the thiosulphate sulphur and sulphate sulphur in solution. Decomposition of lime-sulphur by lead arsenate was greater in the dilute mixtures than in the concentrated. In solutions more concentrated than 1 : 50, the degree of decomposition appeared to be constant. Arsenic appeared to be rendered soluble in the solution, the amount of soluble arsenic being relative to the quantity of hydrogen sulphide evolved.

Lime added to mixtures of lead arsenate and different dilutions of lime-sulphur prevented the decomposition of the sulphide sulphur. The arsenic in solution was decreased as the proportion of lime was increased. Residues resulting from the addition of 1 lb. lime (per 100 U.S. gals.) to mixtures of lime-sulphur and lead arsenate in dilutions ranging from 1 : 20 to 1 : 100 were constant. The reduction in weight of the residues approximated to the weight of lead sulphide present in residues from mixtures of similar dilutions containing no lime. Progressive increase in the proportion of lime added to a 1 : 50 dilution of lime-sulphur and lead arsenate had a varied effect upon the percentage of sulphide sulphur in solution. The addition of 8 oz. lime gave a greater protection from decomposition of the sulphide than any greater quantity under 9 lb.

Dried skim milk added to the different dilutions of the mixture of lime-sulphur and lead arsenate helped to prevent the decomposition of the sulphide sulphur, but not to the same extent as lime. More soluble arsenic was formed than in similar solutions containing no dried milk. Quadruple mixtures of lime-sulphur and lead arsenate containing lime and dried skim milk each in proportions varying from 8 oz. to 3 lb. in 100 U.S. gals. solution prevented decomposition of the sulphides to an extent depending upon the amount of lime and dried skim milk in the mixture, the decomposition of lime-sulphur by lead arsenate being least when the quantities of lime and dried skim milk were equal. The percentage of sulphide sulphur, however, did not equal that found in solutions of lime-sulphur at the same concentration.

Hutson (R.). **Nicotine Sulphate plus Summer Oil for the Control of Tentiform Leaf Miners.**—*J. econ. Ent.* **31** no. 3 p. 455. Menasha, Wis., June 1938.

A severe outbreak of *Parornix* (*Ornix*) *geminatella*, Pack., was noticed in an orchard in Michigan in September 1936, and infestation again began to develop in May 1937. A spray of $\frac{3}{4}$ pint 40 per cent. nicotine sulphate and $\frac{1}{2}$ gal. summer oil [per 100 gals.] penetrated the leaf-mines and killed over 90 per cent. of the larvae.

Dorst (H. E.). **Flea Beetle Injury to Sugar Beets in Central Utah.**—*J. econ. Ent.* **31** no. 3 pp. 455–456. Menasha, Wis., June 1938.

In the spring of 1937, *Psylliodes punctulata*, Melsh., bred in enormous numbers on *Cheirinia repanda*, an introduced wild mustard, which in that year covered about 9,000 acres of range land in Utah, as compared with 100 acres in a normal season. When the *Cheirinia* matured, the flea-beetles dispersed to the neighbouring sugar-beet in the cultivated areas of the Sevier Valley in central Utah and did severe damage, totally destroying 1,000 acres of seedlings. They fed principally on the cotyledons and later on the tender foliage. When forced by bad weather to take shelter, they fed on the stems below the soil surface. At the same time, the beet was heavily infested by *Eutettix tenellus*, Baker. A spray of 1 lb. derris powder (2 per cent. rotenone) in 50 U.S. gals. water killed a large proportion of the flea-beetles, but incoming ones soon reinfested the fields. Bordeaux mixture (4 : 4 : 50), to which was added 4 lb. calcium arsenate, applied at the rate of 75 U.S. gals. per acre, gave satisfactory protection.

Schoene (W. J.). **Tobacco Flea Beetle Outbreak.**—*J. econ. Ent.* **31** no. 1 p. 456, 1 fig. Menasha, Wis., June 1938.

A serious outbreak of *Epitrix parvula*, F., occurred on tobacco in Virginia and North Carolina during May and June 1937. Many seedlings were produced despite the infestation and an attack of *Peronospora tabacina* (downy mildew), but they failed to grow after being planted out and in a few days numbers of them died. Many fields were replanted five times before 15th June. It was then found that the injury was being caused in part by larvae of *E. parvula*, 10–12 mature larvae being found in the stems of some plants. The crop in the area affected was reduced by about 20 per cent.

Flanders (S. E.). **Identity of the common Species of American *Trichogramma*.**—*J. econ. Ent.* **31** no. 3 pp. 456–457, 7 refs. Menasha, Wis., June 1938.

Under laboratory conditions, two species of *Trichogramma* existing in America [*R.A.E.*, A **18** 369] are readily distinguished by differences in colour and rate of development. In the field, they may be distinguished by their hosts, which are selected according to their preference for arboreal or field habitats [**25** 719]. The author considers that, on this basis, it is apparent that *T. minutissimum*, Packard, a yellow species reared by S. H. Scudder from eggs of *Papilio glaucus*, L. (form *turnus*, L.), in June and also from those of *Basilarchia archippus*, Cram., is the summer phase of *T. minutum*, Riley, reared from eggs of *B. archippus* on willow in autumn, and that *T. pretiosum* var. *nigra*, Girault, described from dark individuals developing in cold weather in *Heliothis armigera*, Hb. (*obsoleta*, F.), a field host, is the spring or autumn phase of *T. pretiosum*, Riley, described from eggs of *Alabama argillacea*, Hb.

Campbell (R. E.). **The Pyralid Moth, *Lineodes integra* Zell., as a Pest of Eggplant.**—*J. econ. Ent.* **31** no. 3 pp. 457–458, 3 refs. Menasha, Wis., June 1938.

In October 1931, some egg-plants [*Solanum melongena*] in southern California were damaged by larvae of *Lineodes integra*, Zell. In August 1937, tomato plants growing 85 miles further north were found to be infested by the same species. The wide distribution of this Pyralid in North and South America makes it an important potential pest, though, hitherto, it has not been considered an economic species. Injury to egg-plant is similar to that to tomato [*R.A.E.*, A **25** 691]. Adults that emerged between 29th October and 2nd November 1931 were caged on small egg-plants. Oviposition, hatching, pupation and adult emergence took place during the periods 3rd to 17th November, 9th to 17th November, 25th to 31st January and 21st to 31st March, respectively. The adults that emerged on 22nd March oviposited on 29th March, the larvae hatched on 11th April and pupated between 31st May and 2nd June, and adults emerged between 20th and 23rd June. Four females produced a total of 205 eggs ; most of them were laid in about equal numbers on the upper and lower sides of the leaves, but a few were on the buds and petals.

Smith (R. H.). **Reaction of the Codling Moth to Nicotine exposed in Apple Trees.**—*J. econ. Ent.* **31** no. 3 pp. 458–459. Menasha, Wis., June 1938.

In connection with work on the control of adults of the codling moth [*Cydia pomonella*, L.] with nicotine vapour [*cf. R.A.E.*, A **24** 169, etc.], experiments were made in California to determine the effect of nicotine exposed to normal evaporation in apple trees. The trees had a spread and height of about 15 ft. A bait jar was placed near the top of each tree, and 6 small gauze cages each containing 2 moths were suspended in each. Strips of muslin, $1\frac{1}{2} \times 30$ inches, each carrying $\frac{1}{2}$ oz. 50 per cent. free nicotine, were evenly spaced among the cages. Observations were made after 22 hours. There was no significant correlation between the presence of nicotine and the number of moths in the bait jars. The mortality of the moths in the cages was not affected by two strips per tree, but was increased by four strips ; with six it was increased still further and approached 80 per cent.

Barber (G. W.). **New Control Methods for the Corn Ear Worm.**—*J. econ. Ent.* **31** no. 3 p. 459. Menasha, Wis., June 1938.

Experiments during three summers in Connecticut and three winters in Florida have shown that fumigation and oiling are promising methods of protecting ears of maize from *Heliothis armigera*, Hb. (*obsoleta*, F.). For fumigation, a tablet composed of 0·5 gm. hexachlorethane and a suitable carrier is inserted in the tip of the ear as soon as it has become fertilised, and pushed in for an inch or more. The tip of the husk is then fastened with a clip. The evaporating fumigant kills both the larvae that have already entered and those that enter later. This treatment has consistently resulted in 90 per cent. of the ears being uninfested in an area where all untreated ears were infested. The fumigant does not impair the suitability of the maize for food.

Oiling costs only one-third as much, but is somewhat less efficient. A light, highly refined mineral oil of 100–200 Saybolt viscosity is either atomised or sprayed on to the external silks or applied with an oil can at the rate of 0·5–1 cc. per ear. Small larvae that are in the silk or enter it later are smothered, and larger ones usually leave the ears. This method has resulted in 75–89 per cent. of the ears being uninjured. The oil is harmless to man and very little of it reaches the kernels. It does not affect flavour or attractiveness.

Dowden (P. B.) & Berry (P. A.). **European Parasites of *Rhyacionia buoliana* (Schiff.), *Coleophora laricella* Hbn. and *Phyllotoma nemorata* (Fall.).**—*J. econ. Ent.* **31** no. 3 pp. 459–460. Menasha, Wis., June 1938.

Of the 14 parasites of *Rhyacionia buoliana*, Schiff. (European pine shoot moth), 5 of *Coleophora laricella*, Hb. (larch case-bearer), and 5 of *Phyllotoma nemorata*, Fall. (birch leaf-mining sawfly), imported into the United States from Europe since 1931 [*cf. R.A.E.*, A **23** 170], 3 parasites of *Rhyacionia*, *Tetrastichus turionum*, Htg, *Cremastus interruptor*, Grav., and *Orgilus obscurator*, Nees, 2 of *Coleophora*, *Microdus* (*Bassus*) *pumilus*, Ratz., and *Chrysocharis laricinellae*, Ratz., and 2 of *Phyllotoma*, *Phanomeris phyllotomae*, Mues., and *C. laricinellae*, have been recovered from two or more colonisation points. Only a

few adults of each were secured, but in every case, both sexes were represented. In all cases except that of *Cremastus interruptor*, the recoveries were made more than a year after the original liberation.

MILUM (V. G.). **A larval Mermithid,** *Mermis subnigrescens* **Cobb, as a Parasite of the Honeybee.**—*J. econ. Ent.* **31** no. 3 p. 460, 1 ref. Menasha, Wis., June 1938.

An instance is recorded of a worker honey bee being parasitised by a larva of *Mermis subnigrescens*, Cobb [*cf. R.A.E.*, A **26** 123] in Illinois in 1937. The possible way in which the Mermithid may be ingested by a bee is discussed.

PIPER, jr. (W. R.) & DAVIDSON (R. H.). **Methyl Bromide Vapor against five Species of Stored Product Insects.**—*J. econ. Ent.* **31** no. 3 pp. 460–461, 1 ref. Menasha, Wis., June 1938.

From the results of 35 tests of fumigation at atmospheric pressure with methyl bromide made at various room temperatures, concentrations of vapour and periods of exposure on adults of *Calandra* (*Sitophilus*) *granaria*, L., and *Bruchus* (*Acanthoscelides*) *obtectus*, Say, larvae of *Trogoderma versicolor*, Creutz., larvae and adults of *Silvanus gemellatus*, Duv., and larvae of *Tenebrio obscurus*, F., both exposed and covered to a depth of 6 inches by wheat, it was estimated that 1 lb. methyl bromide per 1,000 cu. ft. should be sufficient to kill all of each of the 5 species of insects in 12 hours at a temperature of 58–70°F. Lower dosages may be sufficient or higher ones required in practical fumigation, according to the species concerned and the quantity and nature of the infested material. *Calandra* was the most susceptible of the species studied, *Bruchus*, *Trogoderma*, *Silvanus* and *Tenebrio* being increasingly more resistant in the order named. Under conditions in which all the insects were killed, the germinating powers of wheat, oats, maize and beans were not affected. Immersion in liquid methyl bromide and exposure to its vapour did not affect any of nine common metals nor change the colour of seven wallpapers or of nine samples of dyed cotton goods. No ill effects were experienced by the operators, and the fumigant was found to be non-inflammable and easy to handle.

DIRKS (C. O.). **Biological Studies of Maine Moths by Light Trap Methods.**—*Bull. Me agric. Exp. Sta.* no. 389 pp. 31–162, 22 figs., 79 refs. Orono, Me., November 1937. [Recd. 1938.]

The following is taken from the author's summary: Data on the life-history in southern Maine of numerous species of Macrolepidoptera were obtained by means of light-traps operated on 3 or 4 nights weekly from May to October during the period 1931–34. The traps used for most of the work were lights suspended over large pans of water on which was a film of kerosene. In all, 56,131 moths, representing 349 species, were taken, and of these 77·5 per cent. were males. Data relating to the time of flight and the sex of the moths are given; 82 per cent. of the females were gravid. The number of generations per season and the hours of flight were established for over 100 species, and the known range of distribution of certain species was extended. Warm, cloudy and often rainy nights with little or no wind were most

favourable for capturing moths, large numbers being obtained when the temperature was 58°F. or over, but few or none when it averaged 40–42°F. Owing to the transmission by it of ultra-violet rays, a mercury vapour lamp was found to be superior to two other lamps of greater luminosity.

WAKELAND (C.). **Entomology.**—*Bull. Idaho agric. Exp. Sta.* no. 225 (Rep. 1937) pp. 44–48, 2 figs. Moscow, Idaho, May 1938.

Liberations of *Ephialtes extensor*, Tschb., and *Aenoplex carpocapsae*, Cushm., parasites of the codling moth [*Cydia pomonella*, L.], and *Prospaltella perniciosi*, Tower, a parasite of the San José scale [*Aspidiotus perniciosus*, Comst.], were made in the experimental apple orchard in Idaho in 1937 [*cf. R.A.E.*, A **26** 65]. *P. perniciosi* was not found to be established. Mortality of *Ascogaster carpocapsae*, Vier., previously established on *C. pomonella*, was high, as the host larvae were killed by low temperature. The orchard has not been sprayed for 5 years. The percentages of apples infested by *Cydia* were 98·8 in 1936 and 46·7–66·4 in 1937, but as only 3 per cent. of the larvae examined in November 1937 were parasitised, the reduction cannot be attributed entirely to the effect of parasites. Late in the summer, *A. perniciosus* marked the sound fruit, making it unfit for market, in spite of the increase of the numbers of the parasite, *Aphytis mytilaspidis*, LeB., and the predator, *Scymnillus aterrimus*, Horn, in 1936.

In investigations under the supervision of F. H. Shirck, it was observed that Elaterid beetles congregated under bunches of lucerne and similar shelter, eggs being consequently concentrated in such places. Ovipositing females appeared to penetrate deeper into the soil in bare plots than in moist shaded situations. *Pheletes* (*Limonius*) *californicus*, Mann., deposited more than twice as many eggs in cages in which red clover was planted than in those containing lucerne.

Treatment of the soil with dichlorethylether did not affect the wireworm population ; an emulsion of carbon bisulphide and naphthalene reduced it by 52–71 per cent., but severely damaged young beet plants.

MACKIE (D. B.). **Entomological Service.**—*Bull. Dep. Agric. Calif.* **26** (1937) no. 4 pp. 418–438, 3 figs. Sacramento, Calif., 1938.

In 1937, further attempts were made in California to eradicate the citrus whitefly (*Dialeurodes citri*, Ril. & How.), which had spread to 3 new localities, and *Chrysomphalus obscurus*, Comst., on walnuts, stone-fruits and pecans [*cf. R.A.E.*, A **26** 18]. Investigations showed that Persian walnut (*Juglans regia*) can become a preferred food-plant of *C. obscurus* and that it is injured by sprays that are toxic to the latter ; in the extreme south of the state, oil sprays applied to pecan for 3 years have reduced infestation by 98 per cent. *Lepidosaphes halli*, Green, has been successfully eradicated [*cf. loc. cit.*]. *Hypera variabilis*, Hbst. (*Phytonomus posticus*, Gylh.) was found to have spread still further on lucerne in central California. Fumigation with methyl bromide has proved very satisfactory for destroying *Phthorimaea* (*Gnorimoschema*) *lycopersicella*, Busck, in harvested tomatos, and was also used against *Listroderes obliquus*, Klug, in celery. In cold weather, however, this fumigant was less effective than hydrocyanic acid gas except at much higher dosages, which sometimes caused injury to plants, especially those with a noticeable oil content.

Aleurodes azaleae, Baker & Moles, showed a marked increase in distribution on azaleas; it was heavily parasitised by *Encarsia pergandiella*, Howard. *Ephestia elutella*, Hb., was found attacking stored lima beans in the south-west of the state.

Better control of *Eriophyes pyri*, Pgst., on pears was obtained in the Sacramento Valley, where the mites reproduce in the buds during winter, when sprays were applied at leaf-fall, as they emerge from the buds on warm days. *Paratetranychus pilosus*, C. & F., increased in importance as a pest of deciduous fruit trees, and *Tetranychus pacificus*, McG., became more widespread on grape-vines. Fumigation with low concentrations of hydrocyanic acid gas, generated from calcium cyanide, was tried against mealybugs of the genus *Pseudococcus* on grape-vines, in tents designed to cover several vines in a row; little control was obtained, and higher concentrations are not economically justifiable. In the control of grasshoppers, which again caused severe damage, 42,000 acres of cropped land and 10,200 acres of range were treated with baits; the species present had all been recorded in 1936 [**26** 19]. Field crickets, *Gryllulus* (*Gryllus*) *assimilis*, F., ate into the fruits of melons and fed on seeds in young cotton bolls. The use of aeroplanes for applying arsenical dusts was severely criticised by the public in 1937 owing to the danger to bees and livestock from pasture contamination by drift; 75,929 acres of crops were treated from the air during the year. Liquid insecticides were not so unpopular, and oil sprays were applied successfully by aeroplane against the brown apricot scale [*Lecanium armeniacum*, Crwf.] in the coastal counties [*cf.* **26** 19]. Aeroplanes were used extensively for dusting with sulphur against mites on *Citrus*, and gave good results in dusting with derris compounds against the pear sawfly [*Caliroa limacina*, Retz.] on pear and cherry. They have not, however, proved so satisfactory as ground machines for the application of nicotine dusts, particularly against Aphids, while for the control of the peach twig borer [*Anarsia lineatella*, Zell.] and mites on peach, a single application from the air of mixtures of basic lead arsenate and sulphur was less effective than ordinary spraying.

McCauley (W. E.) & Flint (W. P.). **Outwitting Termites in Illinois.**—*Circ. Ill. nat. Hist. Surv.* no. 30, 19 pp., 19 figs., 1 pl. Urbana, Ill., June 1938.

In this circular are given a popular account of precautions against the infestation of buildings in Illinois by *Reticulitermes flavipes*, Kollar, which is the only important species of termite in the state, and directions for eliminating established infestations. Structural methods of control [*R.A.E.*, A **17** 730; **18** 114; **20** 269, etc.] are most lasting; but supplementary chemical measures [**21** 666; **22** 599] are necessary for the destruction of colonies present beneath or near a building. Chemicals applied as fumigants or dusts have not proved effective in Illinois. The most effective method, adaptable to farm conditions, of treating wood is to heat it to 210°F. for several hours in a bath of creosote, and then allow it to cool either in the bath, or by rapidly submerging it in a bath of cold creosote. A mixture of orthodichlorobenzene and fuel oil or kerosene (1 : 2) at the rate of 1 U.S. gal. for approximately 10 cu. ft. soil is recommended for soil treatment where repellence is unnecessary.

Clinton (G. P.) & McCormick (F. A.). **Dutch Elm Disease** *Graphium ulmi*.—*Bull. Conn. agric. Exp. Sta.* no. 389 pp. 701–752, 8 pls., 183 refs. New Haven, Conn., October 1936. [Recd. 1938.]

This is a review from the extensive literature of the history of Dutch elm disease, caused by *Ceratostomella* (*Graphium*) *ulmi*, in Europe and the United States and of investigations on it, including the part played by Scolytids and possibly other insects in its transmission [*R.A.E.*, A **23** 228; **26** 325, etc.], together with an account of its spread in Connecticut and of laboratory studies there on the structure and life-cycle of the fungus. An appendix contains replies from workers in European countries to a questionnaire issued from Connecticut on the importance of the disease, the rapidity with which it spreads, and the possibility of controlling it.

Sievers (A. F.), Russell (G. A.), Lowman (M. S.), Fowler (E. D.), Erlanson (C. O.) & Little (V. A.). **Studies on the Possibilities of Devil's Shoestring** (*Tephrosia virginiana*) **and other Native Species of** *Tephrosia* **as Commercial Sources of Insecticides.**—*Tech. Bull. U.S. Dep. Agric.* no. 595, 40 pp., 5 pls., 5 figs., 10 refs. Washington, D.C., February 1938.

The following is taken from the authors' summary of a study of the commercial possibilities of American species of *Tephrosia* as sources of insecticides, resulting from the discovery that roots of *T. virginiana* sometimes have insecticidal constituents [*cf. R.A.E.*, A **19** 319, 549] and based partly on cultural investigations in south-western Texas and in other parts of the south and south-east of the United States, where *Tephrosia* is widely distributed: In 1934, investigations on acetone extracts of composite root samples of *T. virginiana* collected from many localities throughout the region of its distribution showed that the Durham colour test gave a fair indication of their toxicity to flies [*cf.* **24** 214], and that the species is toxic only when it grows in a few relatively small districts in Texas, Florida and Georgia. This was confirmed in 1935. Of the 17 species of *Tephrosia* occurring in the south and east of the United States, 12 were studied with regard to their taxonomy and toxicity. Judged by their insecticidal properties and favourable growth habits, *T. virginiana* and *T. latidens* were the only species that showed immediate commercial possibilities; *T. latidens* is abundant in western Florida, where its toxicity is uniform. No definite correlation was found between soil types and the toxicity of either species, or between the inorganic constituents and rotenone contents of the roots. Botanical characters did not appear to be related to the toxicity of individual plants of *T. virginiana*; toxicity varied greatly in both the eastern and western types of the species. Data have been obtained suggesting that the capacity of some species of *Tephrosia* to produce rotenone and related toxic substances is a genetic character, which may be developed by selective breeding [*cf.* **23** 21], but there are indications that it may be modified by environment.

Miscellaneous studies on *T. virginiana* gave the following information: plants growing in close proximity may vary greatly in toxicity, as determined by the Durham test; the herbage is apparently never, and the seed only sometimes, toxic; when the roots are toxic they appear to be uniformly so, regardless of size; the toxic substances

are present in the wood of the roots rather than in the bark ; plants appear to retain their toxicity if their environment remains unchanged ; and the colour-giving substances in properly stored ground roots remain unchanged for some time.

Weber (A. L.), McLean (H. C.), Driggers (B. F.) & O'Neill (W. J.). **Influence of different Materials on Coverage and Adhesiveness of Sprays and their Effect on Residue Removal from Apples.**—*Bull. N.J. agric. Exp. Sta.* no. 627, 16 pp., 7 refs. New Brunswick, N.J., April 1937. [Recd. Sept. 1938.]

The following is based on the authors' summary : A comparison of various spray combinations containing lead arsenate was made on apple trees in New Jersey in 1935 and 1936 to determine their relative effect on the deposition and retention of residue and on spray residue removal from harvested fruit. These treatments differed essentially only in the materials used as adhesives. Samples were taken before and immediately after each treatment, beginning one week after the petal-fall spray and continuing at intervals of 10 days, to determine the effect of weathering throughout the season. Chemical analyses for arsenic and lead were made on measured areas of sprayed foliage. The deposit of arsenic was greater initially and more of it was retained at the end of the weathering period when summer-oil emulsion, bentonite sulphur and dry skim milk were used as adhesives ; pure bentonite resulted in the lowering of the deposition of spray, and retention was only slightly better than on the trees receiving a spray without adhesive ; fish oil, fish-oil soap, sulphonated castor oil, precipitated ferric hydroxide and an aromatic sulphonate showed little build-up or retention effect. With or without an adhesive, one fall of 2·2 ins. rain removed more residue than nine falls totalling 2·49 ins. Although the amount of arsenic deposited and retained on the fruit differed from that retained on the leaf, the adhesives displayed the same relative effects in both cases. The results showed that leaf analyses not only suffice but also largely remove the growth factor in investigations of this type. The addition of adhesives did not make the lead and arsenic residues difficult to remove from the harvested fruit.

In similar tests with sprays containing sulphur, differences were observed in the relative efficiency of some of the adhesives. Of those tested, dry skim milk proved most effective in the deposition and retention of sulphur.

Service and Regulatory Announcements, April–June 1938.—*S.R.A., B.E.P.Q.* no. 135 pp. 39–73. Washington, D.C., U.S. Dep. Agric., September 1938.

An announcement (B.E.P.Q. 474) relating to Quarantine no. 41 against the European corn borer [*Pyrausta nubilalis*, Hb.] in the United States gives two alternative methods by which broom corn [*Sorghum*] and articles made of it may be treated for importation [*R.A.E.*, A **21** 294]. The first is vacuum fumigation for not less than 3 hours with 3 lb. liquid hydrocyanic acid or its equivalent per 1,000 cu. ft. of space at a pressure of 2 inches and a temperature of 60°F. or more, and the second is steam sterilisation effected by reducing the air pressure to 5 inches and exposing the material to a 10 lb.

positive pressure of steam for a period sufficient to assure a constant temperature in all parts of the treating chamber.

Administrative Instructions (B.E.P.Q. 473) describe the method of fumigating potatoes with methyl bromide as a condition of certification for moving by refrigerator car to points outside regulated areas between 15th June and 15th October under Quarantine no. 48 against the Japanese beetle [*Popillia japonica*, Newm.]. Fumigation shall be carried out with 2 lb. methyl bromide per 1,000 cu. ft. of space, including the space occupied by the potatoes and bunkers of the cars, at not less than 70°F. for 2 hours, during which time the car shall remain tightly closed with the plugs in place in the ventilator hatches. Provision shall be made for circulating the mixture of air and fumigant in the car. The operator should use an approved gas mask.

In an announcement (B.E.P.Q. 472) relating to Quarantine no. 64 against the Mexican fruit-fly [*Anastrepha ludens*, Lw.], the time at which fruit in process of sterilisation must be held at 110°F. [**20** 571] is reduced from 8 to 6 hours, provided that the time for heating the fruit to this temperature is at least 8 hours.

Other information in this part includes amendments to summaries already noticed of quarantine restrictions issued by France, Germany, Persia, British Honduras and Brazil.

SEAMANS (H. L.). **The Pale Western Cutworm and its Control.**—*Publ. Dep. Agric. Canada* no. 615, 10 pp., 4 figs. Ottawa, April 1938.

This is a revision of a pamphlet on the bionomics and control of *Porosagrotis* (*Agrotis*) *orthogonia*, Morr. (pale western cutworm) in Canada that has been already noticed [*R.A.E.*, A **14** 478]. An additional method of control by the starvation of the young cutworms in the field [**25** 754] is described. Investigations have shown that it is not the type of soil but the condition of the surface that determines the distribution of the infestation. Oviposition may take place in any field in which the soil surface is loose and dusty.

FENNAH (R. G.). *Citrus* **Pest Investigations.**—*Rep. agric. Dep. Dominica 1937* pp. 27–28. Dominica, 1938.

Observations on *Diaprepes abbreviatus*, L., and *D. esuriens*, Gylh., on *Citrus* in Dominica in September and December 1937 showed that 73·8 and 20–80 per cent., respectively, of the eggs were parasitised; the egg-masses were more numerous in September. The method suggested for exposing the crown roots to protect them from the larvae has been noticed [*R.A.E.*, A **26** 403]. The use of *Tephrosia candida* as a cover crop is recommended, as it is definitely unattractive to the weevils and poisons those that feed on it. It was found that this plant contains a toxic principle that is present in decreasing quantities in the seeds, stem, root-cortex and leaves.

Damage to fruits of orange and grapefruit was chiefly due to mould fungi that entered through punctures made by fruit-piercing moths. Injury to bark round the collar of *Citrus* trees was accompanied by the presence of *Leptostylus praemorsus*, F., but this Lamiid did not attack living wood and was not the primary cause.

Donovan (W. O'B.). **Pests and Diseases ; the Waxy Fly on Limes.**—*Rep. agric. Dep. Grenada 1937* pp. 4, 9. Grenada, 1938.

Insect pests caused little damage to sugar-cane in Grenada in 1937 ; but froghopper blight [*Tomaspis saccharina*, Dist.] was present in some areas [*cf. R.A.E.*, A **23** 606]. *Alabama argillacea*, Hb., severely defoliated cotton in Carriacou in October and November.

A survey by A. Pickles showed that *Orthezia praelonga*, Dougl., was attacking limes in Carriacou over a total area of 55 acres on two estates. It also occurred on *Euphorbia ligularia*, *Malpighia glabra*, *Pisonia subcordata*, *Haematozylon campechianum* and croton (*Cordiaeum* sp.). In Grenada, it was found sporadically on *Citrus* and other plants, but there appeared to be no immediate danger from it in areas where limes are grown.

Report of the Hawaii Agricultural Experiment Station 1937.—117 pp., 16 figs. Honolulu, March 1938.

Sections of this report deal briefly with insect pests in Hawaii in 1937 and with the control of some of them. Adults of *Adoretus sinicus*, Burm., damaged the foliage of beans and appreciably reduced the yield. When weekly applications were made of a pyrethrum dust (1 part dry Pyrocide [*cf. R.A.E.*, A **25** 553] to 9 parts sulphur as carrier), or of repellent sprays of tetramethyl thiuram di- or monosulphide (2 lb. in 180 U.S. gals. water), the dust and the disulphide spray significantly increased the yield. Both sprays partly controlled infestation of beans by *Cosmolyce* (*Lycaena*) *boetica*, L. ; the disulphide was again the more effective, while the dust was valueless.

Phthorimaea sp. and *Heliothis armigera*, Hb. (*obsoleta*, F.) caused losses of 45–60 per cent. on unsprayed tomato plants. No spray or dust gave satisfactory control in the first planting but, in the second, sprays of Coposil [copper ammonium silicate], alone and with 5 per cent. rotenone concentrate or commercial derris, and of tetramethyl thiuram monosulphide gave significant reductions in the percentage of infested fruit. When the tomato plants were staked, the number of fruits produced was reduced by 5–20 per cent., but the number of uninfested fruits was increased. Tomatos were also attacked by *Dacus cucurbitae*, Coq., which caused a loss of approximately 5 per cent. on unsprayed plots, and *Engytatus geniculatus*, Reut.

Other insect pests included *Thrips tabaci*, Lind., on onion, and *Phthorimaea operculella*, Zell., on potato.

Clark (A. F.). **A Survey of the Insect Pests of Eucalyptus in New Zealand.**—*N.Z.J. Sci. Tech.* **19** no. 12 pp. 750–761, 5 figs., 8 refs. Wellington, N.Z., May 1938.

This survey of the insect pests of *Eucalyptus* spp. in New Zealand includes an account of the economic status, distribution and bionomics of the four principal species, all of which are of Australian origin, together with brief notes on the bionomics of some of the natural enemies introduced for their control. Lists are given of the species of *Eucalyptus* most commonly attacked.

The Coccid, *Eriococcus coriaceus*, Mask., is found on many species of *Eucalyptus* in both islands. The females are viviparous, and there are four broods annually that overlap considerably. The crawlers, which are widely distributed by wind, usually settle along the mid-rib

of a leaf or on the soft bark of young twigs. The male scales usually occur under the bark of the trees, or, in warmer localities, on the mid-rib of the leaf. This Coccid exudes quantities of honey-dew on which a sooty fungus grows.

The place at which the Coccid first appeared in 1900, and from which it spread to other districts, was Timaru, on the east coast of the South Island. It reached the North Island, carried by wind, in 1921. At Timaru, it had been brought under complete control by 1908, as a result of the introduction of the Coccinellid, *Rhizobius ventralis*, Erichs., from the North Island, where it was already established as a predator of a Coccid on Norfolk Pine [*Araucaria excelsa*], and from New South Wales. Since then Timaru has served as a centre from which *R. ventralis* has been successfully distributed to other infested areas, and *E. coriaceus* cannot now be generally regarded as a major pest. It still causes considerable damage when it first spreads to a new place, but in most cases *R. ventralis* controls it with remarkable rapidity. The Coccinellid is also predacious on an indigenous scale, *Coccus hesperidum*, L. Prior to 1908, attempts were also made to establish at Timaru two other Coccinellids, *Cryptolaemus montrouzieri*, Muls., from North Auckland, and *Orcus chalybeus*, Boisd., from Australia, but they were unsuccessful on account of the severity of the climate. Natural enemies subsequently introduced from Australia include the Agromyzid, *Pseudoleucopis benefica*, Malloch, and the Tineid, *Stathmopoda melanochra*, Meyr. [**23** 439], which were liberated in 1932 and 1933–34, respectively.

Most of the information on the bionomics of *Gonipterus scutellatus*, Gylh., and on attempts to control it by means of the Mymarid, *Anaphoidea nitens*, Gir., has already been noticed [**16** 250; **20** 45]. This egg-parasite has recently been recovered in the Nelson province and is widely distributed in the North Island. The percentage of parasitism was 70–80 in random field collections of *Gonipterus* eggs at Auckland. The weevil is still a very serious pest, and it will be some time before the presence of the parasite is generally felt. Attempts are being made to secure a Tachinid larval parasite.

Serious losses in plantations in the eastern districts of the South Island are caused by *Paropsis dilatata*, Er. [**19** 221]. Shipments of both the eggs and larvae of this Chrysomelid have been received from Australia and several species of Tachinids have been reared from the latter, as well as an Ichneumonid that is probably a primary parasite. So far no parasites have been reared from the introduced eggs.

Brief descriptions are given of all stages of *Rhicnopeltella eucalypti*, Gah., which occurs freely throughout both islands and infests twigs of *Eucalyptus globulus* [*cf.* **10** 122, 238]. A similar insect that attacks the leaves is thought by some workers to be the same species, but its identity is doubtful. No males of *R. eucalypti* have been found in New Zealand, and reproduction is parthenogenetic. The female, which is capable of laying 80–100 eggs, begins to deposit them just beneath the epidermis of the twigs 1–2 days after emergence. In the early stages, the larva lives in plant fluid that fills a circular pit 3-4 mm. deep, but as development proceeds the surrounding plant tissue becomes dry, hard and discoloured, while the surface of the twig swells considerably and eventually splits. In a badly infested twig or branch, these lesions are very extensive and the cambium and outer tissues are destroyed. The pupa develops rapidly, and the adult emerges through a small circular hole that it makes in the surface

of the twig. In the Nelson district there are two main emergence periods, December–January, when the adults are very numerous, and June–July. Occasional adults emerge in the field at other times. This Eulophid is not a common insect in Australia and no parasites suitable for introduction into New Zealand have been found. Infestation spreads so rapidly and is so severe that the planting of *E. globulus* has been largely abandoned.

The following insects occur freely on *Eucalyptus* in New Zealand, but are of minor importance : the Psyllid, *Rhinocola eucalypti*, Mask., which attacks young foliage of *E. globulus* but is controlled by the Aphelinid, *Pteroptrix maskelli*, Ashm. [**18** 428] ; some Tortricids, of which the most common, *Eucosma* (*Spilonota*) *macropetana*, Meyr., occasionally causes severe injury in young stands of many species of *Eucalyptus* ; the indigenous Eumolpid, *Eucolaspis brunnea*, F., which sporadically damages new foliage, especially in nurseries ; and four species of Cerambycids, all of Australian origin, of which *Tessaromma undatum*, Newm., occurs in the North Island only, and *Coptocercus rubripes*, Boisd., *Phoracantha recurva*, Newm., and *Bethelium mundum*, Blkb., in both islands.

Newman (L. J.) & Elliott (H. G.). **The Pea Weevil,** *Bruchus pisorum* **(Linn.).**—*J. Dep. Agric. W. Aust.* (2) **15** no. 2 pp. 156–158, 2 figs. Perth, W.A., June 1938.

Bruchus pisorum, L., has become such a serious pest in Western Australia that it is no longer profitable to grow peas for seed production. In experiments on control, plantings were made at different dates in 1936, but the results were inconclusive. In further trials in 1937, the percentages of peas infested when the crops ripened in 5 quarter-acre plots sown on 20th July (the usual time of planting), 16th August, 3rd and 20th September, and 4th October were, respectively, 92·5, 73, 42, 45 and 9. The variation in the dates of planting did not reduce the yields per acre. It was necessary to irrigate the plot sown in October, but the extra cost involved was offset by the great reduction in damage. No infestation by the Bruchid occurred in experimental plots of leguminous fodder plants other than peas (*Pisum* spp.).

Hely (P. C.). **The Bronze Orange Bug. A Pest in Citrus Orchards.**—*Agric. Gaz. N.S.W.* **49** pt. 7 pp. 378–380, 2 figs. Sydney, 1st July 1938.

The Pentatomid, *Rhoecocoris sulciventris*, Stål, sometimes causes severe damage to *Citrus* in Queensland and on the north coast of New South Wales [*R.A.E.*, A **23** 396]. Batches of about 14 eggs are usually deposited on the leaves in February or March, and the nymphs, which hatch in a fortnight or less, remain near the egg-mass for a short time before moulting. In the second instar, they hide amongst the foliage, generally on the lower surface of the leaves, where they are very difficult to detect. They remain quiescent throughout the late autumn and winter, and do not begin to feed until the following August, when the temperature rises and young growth appears on the trees. After this, four more moults take place, and the adults begin to appear in early November. They feed on the young foliage during November and December, but after the spring growth has hardened they are able to survive without food for long periods. With the

autumn renewal of growth in January and February, they begin to feed again and pair, and the eggs are deposited 2–3 weeks later.

A winter spray of resin and caustic soda [**19** 714] against the second-instar nymphs is unsatisfactory as it tends to harden the trees in dry weather and complete coverage is difficult to obtain. Furthermore, the presence of the bugs in dangerous numbers is often not noticeable until the spring. In experiments with other insecticides in November 1937, excellent control was obtained with a spray of 1 lb. cubé powder or ground derris root and 1½ lb. soft soap in 40 gals. water. All stages present, including the adults, were killed, but nymphs in the second, third and fourth instars were the most susceptible, while those in the late fifth instar were the most resistant. Sprays of pyrethrum, 1 or 2 lb. in 40 gals., stupefied some of the bugs, but many of them recovered. In an experiment on a medium-sized tree (9×10 ft.), fumigation for 15 minutes with one tablet of a calcium cyanide preparation (10 gm. HCN) brought most of the bugs to the ground, but they soon recovered and started to crawl up the trunk. They were eventually able to cross a 4-inch band of adhesive, but it delayed them for some time and so would facilitate their collection by hand.

Insect Pests and their Control.—*Agric. Gaz. N.S.W.* **49** pt. 7 pp. 391–395, 9 figs. Sydney, 1st July 1938.

This part of a series on insect pests in New South Wales [*cf. R.A.E.*, A **26** 582] includes a very brief account of the bionomics and control of *Maleuterpes spinipes*, Blkb. (*phytolymus*, Oll.) as a pest of *Citrus* [**16** 164], and a note on *Monolepta australis*, Jac., the life-history of which is not known. Adults of the latter have occurred in swarms for the last 4 years and have caused serious damage to maize, *Citrus*, and winter crops of beans [**25** 223]. A dust of equal parts by weight of pyrethrum and kaolin gives the best control.

Zolotarevsky (B.) & Murat (M.). **Rapport scientifique sur les recherches de la Mission d'Etudes de la Biologie des Acridiens en Mauretanie (A. O. F.). (Première Mission : Octobre 1936–Mars 1937).**—*Bull. Soc. Hist. nat. Afr. N.* **29** no. 1–2 pp. 29–103, 7 pls., 1 graph, 1 fldg map, 15 refs. Algiers, 1938.

Between October 1936 and March 1937, an ecological survey was carried out in Mauretania to determine the distribution and the type of habitat of *Schistocerca gregaria*, Forsk. Descriptions are given of the physiography, climate and vegetation of the country, which is divided into three climatic regions, *viz.*, the area between the river Senegal and approximately 18°30′N. lat., which is characterised by a tropical rainfall averaging 6–8 ins. annually, and occurring exclusively in summer ; the belt between 18°30′ and 19°20′N. lat., where both the Mauretanian and tropical régimes exert their influence, and the rainfall, averaging 2–4 ins. annually, may occur in winter and in summer ; and the northern zone, under the influences of Atlantic Mauretanian climate, which can be further subdivided into the littoral belt, where rainfall is small but humidity is high, and water vapour brought from the sea is condensed as frequent dew or fog, and the interior, where rainfall is very irregular, occurs mainly in winter and is confined to mountain massifs.

Mauretania had been free of swarms of *Schistocerca* since early 1935, but individuals of phase *solitaria* were found in a number of habitats,

both in the interior, where they occurred in the Saharo-Sahel between about 19 and 20°N. lat., and near the coast from about 19°N. to beyond the frontier of Rio de Oro, where the northernmost limit is probably determined by low winter temperatures. These habitats are described, and the biometrical measurements of the specimens found in them are given ; the greatest accentuation of *solitaria* characteristics was found in females in the more humid coastal belt. All the places inhabited by *Schistocerca*, in spite of the variety of conditions under which it occurred, had some characteristics in common ; they were relatively flat, with coarse soils (gravels, disintegrated sandstones, screes round isolated peaks, and heaps of shells by the shore), and with part of the ground under a light cover of sand and overgrown by tufted vegetation. The locust was never observed on continuous sand dunes or in areas with uniform diffuse vegetation.

The breeding seasons were found to vary according to the situation of the habitat, as they are determined by humidity. The interior of Mauretania, where rainfall is irregular, cannot provide a possible outbreak area of *Schistocerca*, which leads a precarious existence reproducing during the summer rainy season. In the coastal and sub-coastal belts, however, between Cape Timiris and the southern limit of Rio de Oro, climatic conditions may favour swarming. In its southern part, this belt receives regular summer and occasional winter rains, so that breeding may occur at both seasons. In the north, the winter rains predominate, and these, though irregular, may sometimes last for several months ; this enables *Schistocerca*, which can survive there owing to the constantly high relative humidity, to pass through a series of uninterrupted generations [*cf. R.A.E.*, A **24** 231]. Similar conditions are found further inland in the Adrar Souttouf Massif. All these regions can be considered as outbreak centres, and form the southern section of the probable outbreak area along the Atlantic coast.

STOREY (H. H.). **Investigations of the Mechanism of the Transmission of Plant Viruses by Insect Vectors. II. The Part played by Puncture in Transmission.**—*Proc. roy. Soc.* (B) **125** no. 841 pp. 455–477, 2 pls., 12 refs. London, 5th August 1938.

The following is substantially the author's summary of this paper, which is the second of a series [*cf. R.A.E.*, A **22** 11] and deals with experiments at Amani, Tanganyika, on the transmission of streak disease of maize by active races of *Cicadulina mbila*, Naudé [*cf.* **21** 486] : The probability of infection following a short contact (*e.g.* 1 hour) depends partly on a variable inherent quality in the insect, termed its potency. It appeared that the insect inoculates the virus in distinct doses, each independent in its effect of any other doses due to the same or other insects ; the probability of infection by a group is the probability that one or more of its members alone would have infected. The maize plants used varied somewhat in susceptibility. The probability of infection is not considerably influenced by the removal of the inoculated leaf tissue shortly after the inoculation, or by the length of leaf through which the virus must pass in moving to the stem. The insect can take up virus from the mesophyll in a chlorotic area of a diseased leaf, but not from either the mesophyll or phloem of a green area. Infection sometimes succeeds during a single maintained puncture if it reaches the phloem, but fails if it is artificially prevented

from doing so and also if it is not prolonged for a threshold period of about 5 minutes. The delivery of a dose is apparently determined by some incident that occurs only after a puncture has been maintained for some time.

PAOLI (G.). **Una pianta a seme oleoso della Somalia Italiana.** [A Plant of Italian Somaliland with Oil-producing Seeds.]—*Agric. colon.* **32** pt. 6 pp. 253–255. Florence, June 1938.

In connection with work on the extraction of oil from *Solanum arundo*, a wild plant that occurs in Italian Somaliland, the author observed no pests on it, except for rare and slight infestations of the leaves and fruit by *Aonidiella* (*Aspidiotus*) *orientalis*, Newst., and *Ferrisiana* (*Ferrisia*) *virgata*, Ckll.

PALMA (P.). **Primo contributo allo studio dei Lamellicorni fitofagi. *Hybalus cornifrons* Brullé (Coleoptera : Scarabaeidae).** [First Contribution to the Study of phytophagous Lamellicorns. *H. cornifrons*.]—*Boll. Lab. Ent. agrar. Portici* **1** pp. 329–339, 3 figs., 20 refs. Portici, 27th June 1938.

Adults of *Hybalus cornifrons*, Brullé, caused serious injury to cereals in Sicily early in 1936, and the results are given of observations on it in the province of Agrigento, where wheat was being attacked. The egg and adult of this Orphnid are described. In Sicily, the adults have been seen in abundance at the end of December ; they probably emerge even earlier. The ratio of males to females was 1 : 0·89. Pairing has been observed at the end of February, females in the laboratory began ovipositing on 23rd April, and eggs collected on 11th May hatched in 50 days. The injury done has attracted little notice during the last 30 years, as it has been mostly slight and has often been attributed to other causes. When it is severe, however, the wheat seedlings are attacked from the time that they appear above ground until April and later ; the beetles fray the stems above the root collar with their toothed forelegs and feed on the tissues, and the plants soon die in consequence. In the ground at the foot of each plant are cylindrical holes, usually straight and vertical, in which the beetles live. Cultivated ground with clay soil seems to be preferred. As the beetles do not fly, their spread is very slow.

Suggested measures of control include the suspension of the cultivation of cereals for 2–3 years, surface ploughing in summer to expose the larvae, the use as barriers of trenches or metal strips 2–2½ inches high, the application of dusts of calcium arsenate or a mixture of 1 part barium fluosilicate and 9 parts sulphur or of a bran bait poisoned with 10 per cent. barium fluosilicate, and, in the case of severe infestation, destruction of the adults and larvae in the soil by injections of carbon bisulphide at the rate of about 1 oz. per square yard.

MALENOTTI (E.). **Osservazioni sulla fumaggine della vite nel Trevisano.** [Observations on the Sooty Fungus of the Grape Vine in the Province of Treviso.]—*Atti Accad. Verona* (5) **16** pp. 75–79. Verona, 1938.

The author states that in 1936 sooty fungus following infestations by *Pseudococcus citri*, Risso, caused the loss of the entire grape crop in

some localities in the provinces of Venice and Treviso, but that the fungus is not always dependent on the presence of the Coccid. In a vineyard in which the usual winter measures of pruning and scraping followed by the application of a tar-distillate spray had been applied and in which the Coccid was very scarce in August 1938, a serious outbreak of sooty fungus was recorded at the end of September, apparently due to heavy rain earlier in the month having swollen the grapes, which burst, giving rise to sugary deposits. During work on control of the mealybugs, it was observed that ants fostering them had removed their waxy coating. It is therefore possible that ants may render them more vulnerable to insecticides.

MALENOTTI (E.). **Interruzione artificiale di diapausa in *Cydia molesta*, Busck.** [An artificial Interruption of the Diapause in *C. molesta*.] —*Atti Accad. Verona* (5) **16** pp. 177–186, 1 chart. Verona, 1938.

In the region of Verona, where *Cydia molesta*, Busck, nearly always has five generations a year, many of the last-generation larvae are carried to store-rooms with the harvested peaches and hibernate there in boxes, baskets and fittings. In Venetia, peach boxes and baskets must by law be kept in closed store-rooms from early May until adult emergence is ended (about 20th June in 1937). In an experiment directed by the author, a storage room containing boxes and baskets was heated from 27th January, the temperature gradually rising from 5 to about 31°C. [41–87·8°F.]. High relative humidity was maintained by sprinkling the floor with water. The first adults of *C. molesta* emerged on 13th February when the temperature was 26°C. [78·8°F.], and emergence continued until 15th April, the total number of moths obtained being 15,345. In addition, 2,363 adults of *C. pomonella*, L., emerged between 5th March and 15th April, and Braconid and Ichneumonid parasites were also obtained. In careful counts on 3 days in March, only 22 hibernating larvae of *C. molesta* were found on 240 peach trees of different varieties situated at distances of up to 380 yards from the store-house, a number equivalent to 916 for the 10,000 trees in this orchard, probably not all of which would give rise to adults. The author therefore concludes that the artificial interruption of the diapause destroyed over 94 per cent. of the overwintering population.

PIERI (A.). **Infestioni parassitarie degne di nota in Toscana.** [Insect Infestations worthy of Note in Tuscany.]—*Note Fruttic.* **16** no. 8 pp. 113–117. Pistoia, August 1938.

Notes are given on the occurrence of some orchard pests observed in Tuscany in 1938 up to the end of July. Infestation of peach by *Hyalopterus arundinis*, F. (*pruni*, F.), was slight, but pear was heavily attacked by Aphids, injury being severe on trees that had not been treated with winter insecticides. Treated trees were not attacked in spring, but the infestation spread to them later. Infestation of peach by *Cydia molesta*, Busck, was the lowest recorded for 12–14 years; this great reduction may have been due partly to natural enemies. *Caliroa limacina*, Retz., increased extraordinarily on pear, but the traces of one application of a 0·3 per cent. lead arsenate spray applied early in May against *Cydia pomonella*, L., sufficed to kill the larvae. *Psylla* [*pyricola*, Först.] was very abundant on pear.

GIGANTE (R.). **Il mosaico del tabacco.** [Tobacco Mosaic.]—*Boll. Staz. Pat. veg. Roma* (N.S.) **18** no. 1 pp. 93–130, 15 figs., 1 pl., 3 pp. refs. Rome, 1938.

In 1937, some tobacco plants that had been kept in a greenhouse in Italy completely isolated from insects were placed, in their pots, in the open. After a month, two showed symptoms of mosaic and the author made experiments to ascertain which of the viruses of tobacco was involved. From this work, which is described in detail, he concludes that common tobacco mosaic (Johnson's No. 1 tobacco virus) was concerned. In transmission tests, positive results were obtained by allowing examples of *Macrosiphum solanifolii*, Ashm. (*gei*, auct.), found on the diseased tobacco plants, to feed on healthy plants of tobacco, tomato, *Capsicum annuum*, and egg-plant.

VUKASOVIĆ (P.). **Вукасовић (П.). Contribution à l'étude de *Lymantria dispar* en 1935.** [*In Serbian.*]—*Arh. Min. Pol'oprivr.* **3** no. 4 repr. 41 pp., 8 figs., 10 refs. Belgrade, 1936. (With a Summary in French.) [Recd. September 1938.]

Investigations on *Lymantria dispar*, L., in central Jugoslavia were continued in 1935 in the districts in which an outbreak had occurred on forest and fruit trees in 1934 [*R.A.E.*, A **24** 400–402]. The infestation was on the whole much less severe; the weather was cold and rainy in April and May, and a sudden spell of frost at the beginning of May caused high mortality among the larvae and killed much of the young foliage and buds on the trees, thus depriving the surviving larvae of food. Hatching, pupation and adult emergence all occurred considerably later than in 1934; and the females were only half as abundant as in that year and represented only 30·4–13 per cent. of the total number of moths. In addition to the plants attacked in 1934, the larvae also fed readily on medlar; they again showed a decided preference for apple. In laboratory experiments with 17 species of food-plants, the average durations of the larval stage in days were 31·5 on apple and quince, 32 on apricot, 33 on plum, 36·5 on poplar (which was not attacked in the field), 38·5 on cherry, 40 on wild rose, 44·5 on strawberry, 47 on lime [*Tilia*] and 50 on pear and clover. The percentages of mortality in the larval and pupal stages for larvae reared on these plants were 20, 30, 60, 50, 45, 30, 30, 70, 85, 90 and 95. Apricot was thus exceptional in that rapid development was accompanied by high mortality. No larvae survived on mulberry, peach, lilac, gooseberry, walnut or *Robinia pseudacacia*. The pupal stage lasted 9–13 days. In general, the adults reared from larvae on the more suitable food-plants were the larger; the largest were, however, obtained from the larvae on apricot. When large numbers of young larvae were offered a choice of a number of different plants, many of them wandered from one plant to another for several days before starting to feed and only gradually concentrated on the more suitable plants. An experiment with young larvae in a container light at one end showed that the light would attract them away from food and keep most of them away for days until they died of starvation.

Of parasites reared from mature larvae or pupae collected in the field in different localities in 1934 and 1935, the Diptera as a whole were abundant and the Hymenoptera occurred in very small numbers. The latter comprised the Ichneumonids, *Pimpla inquisitor*, Scop., which has not previously been recorded as a parasite of *L. dispar*,

Theronia atalantae, Poda, and *Barylypa perspicillator*, Grav., the Chalcidoids, *Anastatus bifasciatus*, Boy., *Brachymeria intermedia*, Nees, and *Monodontomerus aereus*, Wlk., and a Braconid of the genus *Apanteles*. Of these, *B. intermedia* occurred most frequently; single adults emerged from parasitised pupae 9–13 days after the appearance of the first adults of the host. *T. atalantae* was next in abundance, but may also have been a hyperparasite of the Diptera, since it has been obtained near Belgrade from the pupae both of the Pyralid, *Psammotis hyalinalis*, Hb., and of its parasite, *Nemorilla floralis*, Fall. The Diptera were reared chiefly from the pupae of *L. dispar* and only seldom from the mature larvae. The species were *Agria* (*Pseudosarcophaga*) *monachae*, Kram., and *Muscina pabulorum*, Fall., which were the most numerous, and *M. stabulans*, Fall., *Compsilura concinnata*, Mg., *Tachina* (*Eutachina*) *larvarum*, L., *Sturmia inconspicua*, Mg., *S. scutellata*, R.-D., *Sarcophaga* (*Thyrsocnema*) *harpax*, Pand., *S.* (*T.*) *schützei*, Kram., and *S.* (*T.*) *uliginosa*, Kram. A species of *Brachymeria* (*Chalcis*) was reared from several of the Dipterous pupae. The average percentages of parasitism of *L. dispar* over the whole infested area, by all parasites and by Diptera only, rose from 60·7 and 41·8, respectively, in 1934 to 69·6 and 69 in 1935. The rate of parasitism was as high in the recently infested localities as in the centres of the outbreak. Its increase in 1935 was due chiefly to the marked reduction in the numbers of available host larvae caused by the unfavourable weather in the spring.

[Vukasović (P.).] **Вукасовић (П.). Observations biologiques sur *Phytodecta fornicata* Brüggem.** [*In Serbian.*]—*Arh. Min. Pol'opriv.* **4** no. 7 repr. 47 pp., 10 figs., 8 refs. Belgrade, 1937. (With a Summary in French.) [Recd. September 1938.]

With the increase in the cultivation of lucerne in Jugoslavia, the Chrysomelid, *Phytodecta fornicata*, Brüggm., is rapidly spreading, and further field and laboratory observations on its bionomics [*cf. R.A.E.*, A **19** 250] were therefore carried out in 1931–36. Descriptions are given of the processes of pairing and embryonal and larval development and of the female genitalia.

It was found that the spring emergence of overwintered adults is delayed by cold weather. Laboratory exeriments showed, however, that an increase in temperature does not interrupt the diapause; thus adults taken from the soil during February and kept at 17–20°C. [62·6–68°F.] moved about for a time but soon re-entered the soil. On the other hand, once activity has been resumed normally, the adults do not re-enter the soil if the temperature drops, but shelter under lumps of earth, stones, etc. The duration of life of overwintered adults varied greatly even in the same year and locality. In 1930, 1931 and 1932, females survived for averages of 49, 80 and 36 days, respectively, and usually oviposited up to death. The longevity of males averaged 60 days in one year and 25–29 days in another, and was not affected by the number of pairings. The adults feed chiefly on lucerne leaves and seldom attack the stems. In the course of its life a female eats 20–50 leaves at the rate of about half a leaf a day. Laboratory experiments in which a larger number of plants was offered to both larvae and adults confirmed those previously recorded [**19** 251]. *Medicago lupulina* is probably the primary food-plant; it is not very abundant in nature, but serves for the preservation of the

species, which increases rapidly in abundance in the presence of cultivated lucerne (*M. sativa*) and so becomes an important pest. When kept without food, the newly hatched larvae died in 2–3 days, and only a few third-instar larvae survived for 5–6 days. The adults usually died in 8–10 days, but those that had just emerged from hibernation survived without food for periods of 22–50 days, with an average of 31. This indicates that the overwintered flea-beetles can survive the period early in spring when vegetation is sparse and *M. lupulina* is usually still absent from the fields.

The total number of eggs deposited by females varied considerably from year to year; totals of 893–2,344 eggs were observed with a mean of 1,550 in 1931, and 607–777 in 1932. The eggs were usually deposited in batches of 9–10 on the upper or lower surface of the leaves. The duration of the egg stage varied by 1–3 days for eggs of the same batch [*cf.* **24** 752]. At 20·5–22·5°C. [68·9–71·6°F.], the average length of the stage was 7 days. The larval and prepupal stages together lasted 14½–15 days at 24·2°C. [75·56°F.], and larval development occupied 16 days at 15°C. [59°F.]. At average temperatures of 25·5, 24·5 and 18–19°C. [77·9, 76·1 and 64·4–66·2°F.], the prepupal stage lasted 4½, 6 and 10 days, respectively. The prepupae require constant and rather high humidity; those that were kept in dry sand died without pupating. Adults emerge from the beginning of June, the period of emergence sometimes lasting over 20 days. They feed on the leaves of lucerne, but do not cause much damage, and re-enter the soil fairly soon for hibernation. In the laboratory, the period of activity lasted 15–16 days. Dissection of diapausing females showed an abundant fat-body and only slightly developed ovaries.

JANCKE (O.). **Versuche zur Bekämpfung des Birnknospenstechers (*Anthonomus cinctus* Kollar). Zugleich ein vorläufiger Beitrag zu seiner Lebensweise.** [Experiments in combating the Pear Blossom Weevil, *A. piri*, Kollar. Being also a preliminary Contribution regarding its Biology.]—*Z. PflKrankh.* **48** pt. 8 pp. 411–424, 6 figs. Stuttgart, 1938.

Of late years, *Anthonomus piri*, Koll. (*cinctus*, Redt.) has become the worst pest of pear in the Palatinate and is increasing in importance in other parts of Germany. Examination in spring of buds that fail to develop usually shows that the leaf buds have been hollowed out by the maturation feeding of the weevils in the previous autumn, while the fruit buds contain the larvae and later the pupae. Such fruit buds usually fall after the adult has emerged, but if the development of the buds is in advance of that of the larvae owing to abnormal conditions, the infestation is not evident until the flower buds have appeared and results merely in a reduction of their number. Destruction of the leaf and fruit buds over several years is followed by a crippled appearance of the branches.

Adults emerged from infested buds in the laboratory in May and emergence continued for 1–2 weeks. The young weevils bored into the shoots and leaf-stalks, remaining active for 4–5 weeks, and then aestivated in cracks in the bark, in rolled-up dry leaves, etc. At the end of August or early in September, they began maturation feeding, boring almost exclusively into either fruit or leaf buds. Pairing occurred about a week later and was repeated throughout the oviposition period, which began at the end of September or the beginning of October and

had usually ended by early December. Females laid about 20 eggs each. They were mostly deposited in the fruit buds, up to 4 having been observed in a single bud, but also occasionally in leaf buds. The first larvae were seen in the field in 1936 during the last ten days of October, but mature and immature eggs were observed up to the second half of January. Some varieties of pear appeared to be more susceptible to attack, but this may be due to their comparatively greater number of buds.

Laboratory and field tests with various insecticides are described in detail and the results are tabulated. As preparations containing pyrethrum gave the best results in the laboratory, the subsequent field tests in 1936 and 1937 were made chiefly with them. It was found that single applications made in late September, before the aestivated weevils began oviposition, of several proprietary pyrethrum sprays reduced the infestation by 89–100 per cent. (75 per cent. in one case). The addition of soft soap did not increase efficiency. A preparation containing pyrethrum and derris gave good control at a high concentration, but one of derris alone was ineffective. Adults of *A. spilotus*, Redt., and *A. pomorum*, L., were also found on the sprayed pear trees in September 1937; the percentage mortality in both species was low. *A. spilotus* has not been recorded as a pest in Germany, having probably been mistaken for the others.

Francke-Grosmann (H.). **Zur Morphologie und Biologie von *Pineus sibiricus* Chol. (=*cembrae* [Chol.] Annand).** [Notes on the Morphology and Biology of *Chermes cembrae*, Cholod.]—*Tharandt. forstl. Jb.* **89** pt. 6 pp. 401–424, 16 figs., 13 refs. Berlin, 1938.

In this paper are recorded the results of several years' observations in Tharandt, Saxony, on *Chermes* (*Pineus*) *cembrae*, Cholod., of which the galls occurred regularly in early summer on spruce. Notes are given on the morphology of the various forms. The author prefers to retain the later name *sibiricus*, Cholod., for the species, on the grounds that it was better described and is better known under that name.

Early in July, the fundatrices hatch from the eggs laid by the sexuales on the shoots, settle on the tips of the shoots, and cause galls on the buds. The galls, which are very varied in shape, are described in detail. At Tharandt they opened from 7th to 10th June; this early date of opening is characteristic to *C. cembrae*. The numerous nymphs that issue from the gall moult on or near it and become large alates. These fly to Cembran pine [*Pinus cembra*] and settle on needles of the preceding year's growth, where they oviposit. Their progeny hatch towards the end of June and settle mainly near the shoot tip, occasionally on the bud, but also in bark cracks or in needle sheaths. They hibernate in the second or third instar and oviposit towards the end of March. Their offspring are in part alate sexuparae and in part apterous virginogeniae; the latter produce another generation of virginogeniae of which the progeny hibernate. The sexuparae fly to spruce, settle on the needles and produce sexuales of which the female lays a single egg under a bud scale from which a spring shoot has grown.

In the case of severe infestations, the growth of the trees, especially *Pinus cembra*, was retarded. Infestation of the pines was considerably reduced by a spray of 6 oz. nicotine and 10 oz. soft soap in 31 gals. water applied in May in two consecutive years. Occasionally an

increase of natural enemies, chiefly larvae of *Scymnus*, has also kept down the numbers of the Aphid, but neither natural enemies nor artificial control can eradicate it.

WHITNEY (R. J.). **A Plague of the Beetle** *Harpalus rufipes* **Degeer.**—*Ent. mon. Mag.* **74** no. 892 pp. 200–201. London, September 1938.

Adults of *Harpalus rufipes*, DeG., were found in large numbers in June 1938 on a housing estate in Warwickshire on land on which potatoes had previously been grown and which was stated to have been heavily infested with wireworms. The beetles occasionally entered houses and, in one instance, pyrethrum powder was used and 300 individuals were swept up in a single night. They were active chiefly at night and appeared to do little damage. No larvae have been found. It is possible that the larvae infesting the potatoes may have been grubs of *H. rufipes*, or the beetles may have been feeding on wireworms. In 1937, beetles had been found in large numbers in trenches left open overnight, but it is not certain whether they were *H. rufipes*.

BROWNE (F. G.). **The Common Malayan Powder-post Beetle,** *Minthea rugicollis* **Walk.** (**Coleoptera—Lyctidae**).—*Malay. Forester* **7** no. 3 pp. 107–120, 3 figs., 15 refs. Kuala Lumpur, July 1938.

In view of the increased commercial demand for sapwood, investigations were carried out for 2 years under normal indoor conditions at Kepong on the bionomics of *Minthea rugicollis*, Wlk., which is the most abundant of the Lyctids that feed on the sapwood of seasoned hardwoods in Malaya, where it is indigenous. Characters are given distinguishing the species in the egg, larval and adult stages. It has been reported in the eastern tropics from Central Africa to India, Burma and Malaya, and is commoner in supervised than in virgin forests, feeding on the exposed wood of girdled trees.

The adult fed in its gallery for some days after emerging and then cut its way out through a small, roughly circular hole; when close stacking of the wood prevented direct egress and made the cutting of a long surface gallery necessary, the wood was considerably disfigured. After a period of activity, during which fighting among the males was common, the beetles tended to congregate in small crevices, avoiding the light, and gnawed the surface of the wood. The damage caused by this feeding was not conspicuous. Pairing may begin immediately after emergence and in four pairs of newly emerged adults was observed to occur at intervals for 30 days. Females oviposited in the pores of the wood, often inserting two eggs into a pore. The young larvae fed in the wood, constructing long irregular galleries that mainly followed the grain, but often turned sharply, presumably towards zones rich in starch. The galleries behind the larvae were filled with fine, flour-like dust, typical of Lyctids, which began to exude later, indicating the presence of newly emerged adults. The prepupal and pupal stages were passed in an oblong chamber, the entrance to which was tightly packed with frass.

Adults were most abundant on plywood in August, November–December and April–May. In tests using sapwood rich in starch, the life-cycle lasted 78–142 days, the variation probably occurring in the

larval stage. In these investigations, adults paired 5 days after emergence, females oviposited 4 days later, and the minimum durations of the prepupal and pupal stages were 2½ and 9½ days, respectively. On the assumption that the egg stage was completed in a week, the larval stage would last a minimum of 50 days. Adult males and females survived for up to 110 and 60 days, respectively, with averages of 41 and 28. The progeny obtained per female averaged a little over 64, of which 45 per cent. were females, and the figures indicated that fertility decreased or ceased entirely after about 30 days.

Although the diameter of the ovipositor averaged only 54 μ, timber of which the sapwood had pores averaging less than about 90 μ was practically immune [*cf. R.A.E.*, **22** 545]. Only starch-containing wood is attacked, the degree of infestation being proportional to the amount of starch present. Attack was confined to sapwood, but sometimes extended with the starch-bearing zone well into the log in such timbers as jelutong (*Dyera costulata*), in which there is no sharp distinction between sapwood and heartwood. The Lyctid was observed by the author in the wood of trees belonging to 93 species in 52 genera ; lists are given of these and of susceptible and resistant species. Closely related species may show similar comparative susceptibility.

Examination of a number of samples of plywood showed that approximately 45 per cent. of the immature stages of the beetle had been parasitised. Ectoparasites of the larvae and pupae bred from infested plywood at Kepong comprised *Monolexis* sp., which was found to be capable of preventing the increase of its host under favourable conditions, *Cephalonomia* sp. and *Sclerodermus* sp. *Cerocephala* sp. was suspected as being at least a facultative hyperparasite. The predacious Clerid, *Tarsostenus univittatus*, Rossi, which is distributed throughout the range of the Lyctidae, is probably the best known enemy of *M. rugicollis*, but it is doubtful whether it has much effect on its abundance. The larva is an active burrower and feeds on the immature stages, while the adults feed mainly, but not very voraciously, on the adults. Mites were usually abundant in the galleries, but acted chiefly as scavengers ; some were saprophytic.

Very little work on the control of Lyctids has been carried out in Malaya ; the known methods are reviewed from the literature and include sterilisation of infested timber [**25** 669, etc.], the use of preservatives to prevent infestation [**24** 373, etc.], seasoning in the log [**20** 455] and storage in water to render timber immune from attack ; wide stacking is suggested to enable females of *Monolexis* to oviposit and to eliminate disfiguring surface galleries.

Beeson (C. F. C.). **Undergrowth and the Biological Control of Teak Defoliators.**—*Indian For.* 1938 pp. 485–492. Calcutta, August 1938.

As a result of further investigations on the value of undergrowth in the biological control of *Hapalia machaeralis*, Wlk., and *Hyblaea puera*, Cram., in teak plantations in India [*cf. R.A.E.*, A **24** 96], lists are given of species of plants desirable because they are the food-plants of alternative hosts of parasites of these moths, or undesirable because they are alternative food-plants of the latter or other pests of teak. The first list shows the Lepidoptera attacking the various

plants, the parasites of which they are hosts, and whether the latter attack *Hapalia*, *Hyblaea* or both. The plants decrease in value according to whether they support alternative hosts of parasites common to both *Hapalia* and *Hyblaea*, of polyphagous parasites that attack one of them, or of parasites of *Hapalia* having only one other host. *Hapalia* is more extensively controlled by auxiliary parasites than is *Hyblaea*; the most important auxiliary plant for the latter is *Holarrhena antidysenterica*, which supports *Margaronia laticostalis*, Gn., the alternative host of *Sturmia inconspicuella*, Baranov, which is often the most abundant parasite of *Hapalia* and also attacks *Hyblaea*. Tables are given showing the distribution of the identified parasites of *Hapalia* and *Hyblaea*.

In August and September 1937, 24,000 individuals of *Cedria paradoxa*, Wlkn., reared from 1,000 imported from the United Provinces in March, were released in Madras, mainly where *Lygropia* spp. were defoliating *Helicteres isora*, and a further 16,000 were released in the next two months, mainly where *Hapalia* was beginning to increase. Cocoons of this Braconid were found on *Helicteres* in November 1937, and on fallen teak leaves in April 1938. It is not a parasite of *Hyblaea*. It was also shipped from Madras to Burma, where it was reared and released, and 53 shipments of teak defoliator parasites were successfully sent from Burma to Madras.

Trichogramma minutum, Riley, was imported from Mysore; 23 generations were reared, and 9,250 individuals were released in teak and mahogany plantations in 4 localities in Madras. This parasite bred in eggs of *Hyblaea* and also in those of *Hypsipyla robusta*, Moore, on mahogany, but not in those of *Hapalia*. An unidentified species of *Trichogramma* from Burma was reared with difficulty in eggs of *Hyblaea*, and a small colony was released.

Pruthi (H. S.) & Batra (H. N.). **A preliminary annotated List of Fruit Pests of the North-West Frontier Province.**—*Misc. Bull. imp. Coun. agric. Res.* (*India*) no. 19, 22 pp. Delhi, 1938. Price 1*s.* 9*d.*

This bulletin deals with 55 insect pests of fruit trees, vines and melons in the North-West Frontier Province of India, giving notes on their local distribution, and in many cases the kind of damage they cause, their other food-plants and their seasonal history. The major pests are *Anuraphis padi*, L. (*Brachycaudus pruni*, auct.) and *Myzus persicae*, Sulz., on peach; *Dacus* (*Chaetodacus*) *ferrugineus* var. *dorsalis*, Hendel, on peach and guava; *Carpomyia vesuviana*, Costa, on *Zizyphus jujuba*; *Eurytoma samsonovi*, Vass., on apricot; *Aspidiotus perniciosus*, Comst., on apple; *Cydia pomonella*, L., on apple and pear; an unidentified Aphid on pear; *Diaphorina citri*, Kuway., *Dialeurodes citri*, Ril. & How., and *Drosicha contrahens*, Wlk., on *Citrus*; *Batocera rubus*, L., and an undescribed Cecidomyid on fig, the latter infesting the fruits; and *Raphidopalpa* (*Aulacophora*) *foveicollis*, Lucas, and *Dacus* (*Chaetodacus*) *cucurbitae*, Coq., on melons and other cucurbits.

Franssen (C. J. H.) & Muller (H. R. A.). **Plagen en ziekten van het katoengewas op Java.** [Pests and Diseases of the Cotton Crop in Java.]—*Landbouw* **14** pp. 321–362, 3 pls., 22 refs. Buitenzorg, 1938. (With a Summary in English.)

The bulk of this paper deals with insects; it includes brief notes on 23 species that cause minor injury to cotton in Java and more detailed

information on the more important pests, which are *Platyedra gossypiella*, Saund., *Earias fabia*, Stoll, the Curculionids, *Amorphoidea pectoralis*, Mshl. [*R.A.E.*, A **26** 106] and *Hypomeces squamosus*, F., and a Jassid of the genus *Empoasca*.

The eggs of *P. gossypiella* are laid singly on the green bolls, flowers, leaves, shoots and buds, and the larvae bore into the bolls or buds and pupate in cocoons on the plant or in the soil. Long-cycle larvae have not been found in Java. At Buitenzorg, the egg, larval and pupal stages lasted 4, 13–30, and 6–8 days, respectively. Only 25 parasites were bred from about 10,000 larvae. *Thespesia lampas* and *Abutilon indicum* serve as alternative food-plants and should be destroyed. Cotton should be grown as an annual crop, and varieties that mature quickly should be planted simultaneously, so that the interval between cotton seasons may be as long as possible. This practice and the destruction of alternative food-plants is also recommended against *Earias* and *Amorphoidea*. Seed should be fumigated with carbon bisulphide.

The larvae of *Earias fabia* bore into the shoots and bolls, on which the eggs are laid singly. Pupation takes place in a cocoon on the plants. At Buitenzorg, the egg, larval and pupal stages lasted 3, 18 and 9 days, respectively. The food-plants noted are *T. lampas*, *Urena lobata* and species of *Hibiscus* and *Sida*. In the case of young plants all attacked shoots and bolls should be cut off, but in older plants continual cutting prevents blooming.

Amorphoidea pectoralis is a serious pest in East Java. The eggs are laid in the ovaries of the flowers and bolls, and the larvae eat the young seeds and other soft parts, causing the young bolls to fall off. The egg and larval stages together took about 8 days in the laboratory at Buitenzorg. Adults caught in the field lived up to 2 months. *Thespesia lampas* is the only alternative food-plant known. If necessary, the adults can be controlled by dusting with 1 part lead or calcium arsenate mixed with 9 parts talc. The larvae and adults of *Hypomeces squamosus* are polyphagous. The former kill the cotton plants by gnawing the roots just below the soil surface, and the latter destroy leaves, but may be controlled by dusting with lead arsenate and talc (1 : 9).

The bionomics of the species of *Empoasca* are as yet unknown; it does not attack varieties of cotton with hairy leaves.

Spoon (W.). **Derriswortel als handelsproduct.** [Derris Root as a commercial Product.]—*Tijdschr. PlZiekt.* **44** pt. 4 pp. 214–216, 5 refs. Wageningen, 1938.

In view of the fact that the insecticidal value of derris root is assessed by the two standards of rotenone content and yield of total ether extract, *Derris elliptica* being richer in the former and *D. malaccensis* in the latter [*cf. R.A.E.*, A **21** 617; **24** 87], the author briefly discusses the specifications that are desirable. A definite minimum ratio between rotenone and ether extract should be maintained. Thus, when they are to be used for spraying, derris powders that yield 4, 5, or 8 per cent. rotenone should also yield 12, 14 or 20 per cent. ether extract, respectively. Similarly, mixed derris dusts that contain 0·5, 0·75, or 1 per cent. rotenone should also contain 2, 2·5, or 3 per cent. ether extract. Roots of the types of *D. malaccensis* may be mixed with others to bring the amount of ether extract up to the required standard.

Akiyama (T.). **Life-history of** *Lema tristis* **Herbst in north Manchuria.** [*In Japanese.*]—*Manchuria biol. Soc. Rep.* **1** no. 3 pp. 49–50. Hoten, Manchuria, 1938.

Lema tristis, Hbst., is one of the most important pests of Italian millet [*Setaria italica*] in Manchuria, where it has one generation a year. The adults overwinter among dried plants and in stubble, and resume feeding in June, also attacking wheat, rice and rye, and to a very slight extent barley and maize. The females deposit about 37 eggs, usually singly and on the upper sides of the leaves, from mid-June to July. The eggs hatch in 4–9 days, and the larvae feed for 15–26 days on the young leaves, preferring those of Italian millet, and pupate in the soil. The pupal stage lasts 7–13 days, and the adults emerge from late July to early September. They feed for a time and begin to enter hibernation in late September. The males and females live for 326–400 and 329–410 days, respectively.

Murayama (J.). **Recherches sur les insects chez la terre des Pépinières dans la Corée.** [*In Japanese.*]—*Bull. For. Exp. Sta. Korea* no. 29, 86 pp., 3 figs. Keijo, Korea, 1938.

The results are given of investigations on soil pests in nurseries of forest trees in various parts of Korea. Of the pests taken, 82·3 per cent. were insects and 87·4 per cent. of the latter were Coleoptera, of which 83·7 per cent. were Lamellicorns. A list is given of the species collected, with descriptions of each stage, and notes on the bionomics of the more important, which included *Barathra brassicae*, L., and *Gryllotalpa africana*, P. de B., in addition to Lamellicorns. Of the latter, *Anomala* (*Phyllopertha*) *pallidipennis*, Reitt., is common and is widely distributed over Korea. The larvae are polyphagous and feed particularly on the roots of *Lespedeza*, larch, ash, *Prunus* and pine. A female lays about 20 eggs, which hatch in 2 weeks. *Anomala chamaeleon*, Fairm., which hibernates as a third-instar larva, is common; the adults emerge in July and August and feed on *Prunus*, alder, willow and grape-vines. The adults of *Aserica* (*Serica*) *orientalis*, Motsch., which has one generation a year, emerge in late June and July, overwinter, resume feeding in late March and oviposit in April and May. The larvae feed on roots of various weeds and young trees, sometimes injuring the rootlets of conifers. *Lachnosterna* (*Holotrichia*) *diomphalia*, Bates, has a two-year life-cycle and hibernates in both the larval and adult stages. The larvae are common in pine forests, and the adults feed on fruit trees.

Nakayama (S.). **Notes on the Biology of** *Naranga aenescens*, **Moore.** [*In Japanese.*]—*Ann. agric. Exp. Sta. Tyosen* **10** no. 1 pp. 8–32, 2 pls., 18 refs. Suigen, Korea, May 1938. (With a Summary in English.)

Outbreaks of *Naranga aenescens*, Moore, which is one of the most injurious pests of rice in Korea, occur at intervals of 3–5 years. In years preceding outbreaks a greater number of pupae from early broods hibernate, and this leads to an increased population in spring. There are usually 4 generations a year, the adults emerging in May, June, July and August. In experiments, females lived for about 5 days and deposited 22–280 eggs, with an average of 107, on rice, beginning 2–3 days after emergence. The length of the egg stage varied from 6–7 days in May to 2–3 in August, and up to 97 per cent. of eggs hatched.

In the first instar, the larvae fed on the epidermis of the leaves between veins, but later they attacked the edge of the leaves. They pupated in cocoons at the leaf-tips, which they bent over. The larval and pupal stages lasted 12-30 and 4–6 days, respectively. The larvae were attacked by four Hymenopterous parasites, of which two were *Apanteles glomeratus*, L., and *Elachertus tabashii*, sp. n. The new species is described. Good control of *Naranga* was given by sprays of pyrethrum-soap or lead arsenate.

Yokoo (T.) & Taguti (K.). **Some Observations on *Araeocerus fasciculatus* DeGeer, as a Pest of Chinese Yeast in Korea.** [*In Japanese.*]—*Ann. agric. Exp. Sta. Tyosen* **10** no. 1 pp. 69–78, 3 pls. Suigen, Korea, 1938.

Larvae of the Anthribid, *Araecerus* (*Araeocerus*) *fasciculatus*, DeG., all stages of which are described, have been observed in Korea feeding on Chinese yeast, sometimes causing serious damage. All stages occur from June to December. Females survived for an average of 27·5 days, males somewhat less, pairing occurred 2–16 days after emergence, and females oviposited 3 days later. The larval stage lasted about 14–28 days and the pupal stage averaged 12·8. The larvae accepted cotton seeds in captivity, but preferred the yeast. In experiments, adults were killed by exposure to 50°C. [122°F.] for 30 minutes, and complete mortality of all stages in a room was obtained by keeping it at this temperature for 3 days, or by fumigation with chloropicrin at the rate of 1·6 oz. per 1,000 cu. ft. for 1 day.

Ijima (K.). **Studies on the Biology of *Eucosma schistaceana* Snellen in Formosa. Part I. The Biology of the Adult Moth.** [*In Japanese.*]—*Rep. Govt Sug. Exp. Sta. Formosa* no. 5 pp. 73–115, 8 figs. Formosa, 1938. (With a Summary in English).

Emergence of adults of *Eucosma schistaceana*, Sn., occurs throughout the year in Formosa ; it is most intense in May and December and least so in February and August. The numbers of the two sexes are about equal. Males and females lived 9 and 10·3 days on an average, females of medium size surviving longest. Pairing occurred soon after emergence, and females oviposited during the following night. About 22 per cent. of the eggs in the ovaries matured 24 hours after emergence ; the oviposition period averaged 18·7 days in December and January and 6–8 days in other months. Females remained in sheltered places during the daytime and oviposited mostly in the evening. The eggs were laid on the leaves and sometimes on the stalks of sugar-cane, especially on the lower sides of the basal and middle parts of full-grown leaves of the current season. The numbers laid by individual females varied directly with body length and averaged 240. When newly emerged females were kept at 10°C. [50°F.], 18·3 per cent. of the eggs in the ovaries matured in 8 days. The moths were not usually attracted to light ; they fed on honey and sugar solutions in captivity.

Takano (S.) & Noda (I.). **A morphological and ecological Study of *Synonycha grandis* Thunberg in Formosa.** [*In Japanese.*]—*Rep. Govt Sug. Exp. Sta. Formosa* no. 5 pp. 116–138, 1 pl. Formosa, 1938. (With a Summary in English.)

The Coccinellid, *Synonycha grandis*, Thnb., all stages of which are described, is predacious on various Aphids in Formosa, particularly

Oregma (*Ceratovacuna*) *lanigera*, Zehnt., a serious pest of sugar-cane [*cf. R.A.E.*, A **22** 522]. It has about 11 generations a year, the egg, larval and pupal stages lasting 4–9, 9–20 and 4–13 days, respectively. Adults lived 30–70 days in summer, 60–90 in winter, and up to 6 months when the sexes were separated. Pairing, which takes place more than once during life, began 3–7 days after emergence, and females began to oviposit 5–16 days after emergence, chiefly near Aphid colonies. The oviposition period lasted 1–2 months. The average number of eggs laid was 673, in masses of about 27. Females fed solely on sugar solution or wheat flour did not oviposit. The eggs did not hatch at temperatures above 29·5°C. [85·1°F.] ; the percentages hatching at 29·1, 23 and 19–22°C. [84·38, 73·4 and 66·2–71·6°F.] were 2, about 50 and 61–66, the last temperature being the optimum. Newly hatched larvae were gregarious for 3 or 4 days at about 15°C. [59°F.] but separated in less than a day at 20–25°C. [68–77° F.]. A larva consumes a total of about 720 Aphids, and the adults several thousands. *O. lanigera* is most abundant on sugar-cane from October to May [*cf.* **22** 521], but the Coccinellid usually does not appear until November or December and is most numerous at the end of the period, after which it suffers great mortality for lack of food. The adults, however, can be kept in cold storage until the Aphid becomes abundant, and liberated at outbreak centres.

Takahashi (H.). **On the Outbreaks of *Hieroglyphus annulicornis* Shiraki and Methods for its Control.** [*In Japanese.*]—*J. Formosan Sug. Plant. Ass.* **16** no. 9 pp. 205–218, 2 pls. Taichu, Formosa, September 1938.

The Acridid, *Hieroglyphus annulicornis*, Shir., all stages of which are described, usually breeds on *Miscanthus* in Formosa, but sometimes migrates to sugar-cane and causes serious damage. The outbreaks occur in the southern part of the island, and a very severe one developed in 1938, when over 80,000 hoppers per acre were observed in the cane fields in June. Rainfall in May appears to exercise some control on the hoppers, and outbreaks may be partly attributable to lack of rain in that month. There is one generation a year, the hoppers hatch in April or May and become adult about the end of June, and the females deposit 80–90 eggs in the soil from July to September. Varieties of sugar-cane having erect leaves are preferred ; *Imperata*, *Phragmites*, bamboo and maize are also attacked. Control measures include crushing the hoppers found on sugar-cane, ploughing infested fields before the eggs hatch, and the destruction of wild food-plants near cane fields.

Harukawa (C.) & Tokunaga (M.). **Studies on the Life History and Bionomics of *Phyllotreta vittata* Fabricius I.**—*Mem. Coll. Agric. Kyoto Univ.* no. 44 (Ent. Ser. no. 5) 48 pp., 23 figs., 15 refs. Kyoto, May 1938.

In this first report are given the results of a laboratory study of the bionomics of *Phyllotreta vittata*, F., carried out in Japan from March to December 1937. This flea-beetle is a serious pest of cultivated crucifers [*cf. R.A.E.*, A **24** 696], and the observations were made on adults taken in the field on radish and their offspring, which were bred on radish at an average temperature of 26°C. [78·8°F.] and a relative humidity of almost 100 per cent. Descriptions are given

of the morphology of all stages, the larva and pupa being treated in great detail, the development of the immature stages and the characters distinguishing the sexes of the pupae and adults. The larvae were unable to hatch when the eggs were incubated on a dry substratum at less than 100 per cent. relative humidity, but eggs containing mature embryos that were transferred to moist paper hatched normally. The egg, larval, prepupal and pupal stages averaged 4·6, 11·3, 3·2 and 7·2 days, respectively, and adults survived for several months. Of the pupae reared, 48·7 per cent. were females. Emergence took place before the adults were sexually mature and was followed by a long period of maturation feeding and a long oviposition period.

YAGI (N.). **Determination of living and dead Insects of Coccidae by the Reaction of Methylene Blue.** [*In Japanese.*]—*Oyo Kontyû* **1** no. 1 pp. 1–2, 1 pl. Tokyo, August 1938.

The author found it possible to determine whether Coccids were living or dead by crushing them in a solution of methylene blue (5–7 mg. per 100 cc. distilled water). If they were alive, they changed the solution to white in 1–3 minutes ; if they were dead, they caused it to become darker blue. The test should not be made for at least 3 hours after fumigation with hydrocyanic acid gas, since the fumigant affects the reagent.

OKAZAKI (K.). **On the Method of Trapping the hibernating Larvae of the Rice Borer,** *Chilo simplex* **Butl., and History of its Application as a Means of Control.** [*In Japanese.*]—*Oyo Kontyû* **1** no. 1 pp. 11–18. Tokyo, August 1938.

Larvae of *Chilo simplex*, Btlr., leave rice straws heaped in store-houses after harvest in search of hibernation quarters. They readily enter medium-sized dried stalks of *Polygonum* laid on the heaps, and may thus be trapped. The *Polygonum* should be kept in position until late December or early January. This method has been in use for many years in some localities in Japan.

HORI (M.). **An Example of effective Control of** *Chortophila flavopicta* **Mats.** [*In Japanese.*]—*Oyo Kontyû* **1** no. 1 pp. 27–30. Tokyo, August 1938.

Hylemyia (*Chortophila*) *flavopicta*, Mats., is a serious pest of radish and other crucifers in Hokkaido and Sakhalin. In Sakhalin, where it has one generation a year, the adults emerge from the overwintered pupae in the second half of July and August. The eggs, which are laid on the food-plants or among clods near them, hatch in 8–10 days, and the larvae become full-fed in about a month. A proprietary spray containing mercury bichloride gave good control when applied 5–6 times to the basal parts of the plants, starting just before the eggs hatched.

YAMADA (Y.). **On the Life-history of** *Tineola biselliella* **Hamps.** [*In Japanese.*]—*Bochu Kagaku* no. 2 pp. 13–16, 4 pls. Kyoto, 1938.

Tineola biselliella, Humm., all stages of which are briefly described, is a common pest of woollen goods near Kyoto. It has 2 generations

a year, the first adults of which emerge in early May and August, and the winter is passed in the larval stage. Females deposit 14–15 eggs singly. The egg stage lasts 2 weeks, and the pupal stage about 10–14 days in summer.

Ohta (Y.). **On a Pest of** *Salix*, *Lygaeonematus* **sp.** [*In Japanese.*]—*Insect World* **42** pp. 150–151, 1 pl. Gifu, 1938.

A description is given of the larva of an unidentified species of *Pristiphora* (*Lygaeonematus*) that was observed feeding on the young leaves and buds of basket willow at Gifu.

Ohta (Y.). **On** *Pyrausta phoenicealis* **Hübn.** [*In Japanese.*]—*Insect World* **42** pp. 217–219. Gifu, 1938.

Brief notes are given on the Pyralid, *Pyrausta phoenicealis*, Hb., the larvae of which feed on the leaves of *Perilla frutescens* var. *crispa* grown as a vegetable at Gifu.

Mori (N.). **On** *Galerucella distincta* **Baly.** [*In Japanese.*]—*J. Plant Prot.* **25** no. 9 pp. 687–692. Tokyo, 1938.

Observations on the bionomics of *Galerucella distincta*, Baly, on strawberry in Japan [*cf. R.A.E.*, A **21** 357] showed that the adults begin to emerge from hibernation in late April, and that the various stages are present until September. Females deposit batches of about 24 eggs on the leaves. The larvae feed and pupate on the leaves, and in summer the egg, larval and pupal stages averaged 5, 12·4 and 3·5 days, respectively, while adult longevity averaged 58 days. All stages of this Galerucid are described.

Imai (S.). **On a new Insecticide against the Larvae of** *Tipula aino* **Alex. in Rice Seed-beds** [*In Japanese.*]—*J. Plant Prot.* **25** no. 10 pp. 754–761. Tokyo, 1938.

Good control of larvae of *Tipula aino*, Alexander, in rice seed-beds in Japan was obtained with a solution prepared by melting 3 lb. naphthalene and 1 lb. soap, adding 2 gals. hot water, diluting with 5 gals. water and stirring for 2–3 minutes. For use, it is diluted with 3 parts water and sprayed on the beds after they have been drained. The larvae emerge from the soil and die in 8 minutes.

Toyoshima (A.). **Studies on** *Aphelinus mali* **Hald., a Parasite of** *Eriosoma lanigerum* **Hausm. 1.** [*In Japanese.*]—*Apple Exp. Sta. Aomori Pref. Rep.* **1** 23 pp., 5 pls. Aomori, Japan, 1938.

Eriosoma lanigerum, Hsm., was first found in Aomori Prefecture, northern Honshu, about 1882 [*cf. R.A.E.*, A **25** 335] and is now a serious pest of apple. Its chief natural enemies in this prefecture are *Coccinella* (*Harmonia*) *axiridis*, Pall., *Chrysopa septempunctata cognata*, McLach., and *Syrphus balteatus*, DeG., but their activities are limited to the summer. *Aphelinus mali*, Hald., was imported from Oregon in 1931 and about 300 living adults reached Aomori; the parasite has since become established in the field. It has 8 or 9 generations a year, and the larvae, which overwinter from mid-October,

are able to resist temperatures as low as −18°C. [0·4°F.]. It very occasionally hibernates in the pupal stage. The adults, which emerge from May onwards, survive for about 5 days without food in captivity, and females oviposit even in hosts below the surface of the soil. Parasitised Aphids turn blackish in 6 or 7 days and sometimes migrate to the lower surface of the leaves.

PAPERS NOTICED BY TITLE ONLY.

MARELLI (C. A.). **Un microhimenóptero Proctotrupoideo** *Telenomus almanzori* **n. sp., de la familia Scelionidos, parasito de los desoves del bicho quemador,** *Hylesia nigricans*. [*T. almanzori*, sp. n., a Scelionid Egg-parasite of *H. nigricans*, Berg, in Argentina.]—*Mem. Jardin zool.* **7** (1936–37) pp. 161–174, 2 pls. La Plata, 1937.

FELT (E. P.). **The Literature of American Economic Entomology** [a general discussion].—*J. econ. Ent.* **31** no. 3 pp. 353–356. Menasha, Wis., June 1938.

KNOWLTON (G. F.) & SMITH (C. F.). **The Aphid Genus** *Pseudoepameibaphis*. [Descriptions of five species, three new, on *Artemisia* in Utah and neighbouring states.]—*J. N.Y. ent. Soc.* **46** no. 2 pp. 217–222, 1 diagr. New York, N.Y., June 1938.

KAWECKI (Z.). **The Coccidae of the Tatra-Mts. Part I** [LECANIINAE and ORTHEZIINAE]. [*In Polish.*]—*Spraw. Kom. fizjogr. Polsk. Akad. Um.* **71** (1936) pp. 199–208, 1 pl., 14 refs. Kraków, 1938. (With a Summary in English.)

TREHAN (K. N.). **Two new Species of Aleurodidae** [*Aleuroplatus kewensis* and *Trialeurodes williamsi*] **found on Ferns in Greenhouses in Britain (Hemiptera).**—*Proc. R. ent. Soc. Lond.* (B) **7** pt. 9 pp. 182–189, 42 figs. London, 15th September 1938.

DE VORE (LL.), POPP (H. W.), HAM (W. R.) & DUNCAN (D. C.). **Methods of Measuring Radiation for Biological Purposes, including a new Densitometer Method.**—*Bull. Pa agric. Exp. Sta.* no. 359, 40 pp., 6 figs., many refs. State College, Pa., May 1938.

MARTIN (J. T.). **The Chemical Evaluation of Pyrethrum Flowers** (*Chrysanthemum cinerariaefolium*). **A Comparison of several Methods.**—*J. agric. Sci.* **28** pt. 3 pp. 456–471, 14 refs. London, July 1938.

HERSCHLER (A.). **Ein Schnellverfahren zur Feststellung des Arsengehalts von Spritzbrühen unter Heranziehung der Lockemannschen Methode.** [A rapid Process for determining the Arsenic Content of Sprays in which Use is made of the Lockemann Method.]—*NachrBl. dtsch. PflSchDienst* **18** no. 7 pp. 60–61. Berlin, July 1938.

RICE (E. M.) & ROY (B. K. Datta). **A rapid Method for the Estimation of the Arsenious Oxide Content of Paris Green.**—*J. Malar. Inst. India* **1** no. 2 pp. 123–128, 1 pl., 2 refs. Calcutta, June 1938.

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